FACTORY

MANAGEMENT AND MAINTENANCE

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OCTOBER 1942

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Are War Production Drives Worth While? — page 74

How to Add Life to Electrical Equipment — page 121

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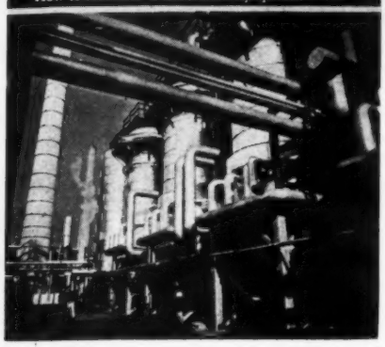

On the cover, equipment used in Houdry catalytic cracking process. Kodachrome taken by William Rittase at one of the refineries of Sun Oil Company. The Houdry process enables refiners to supply the high octane gas so vital to the war effort. In 1936 there was a single unit in operation with a capacity of 2000 barrels daily. The many units now in operation in America have a capacity of hundreds of times that amount.

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MANAGEMENT AND MAINTENANCE

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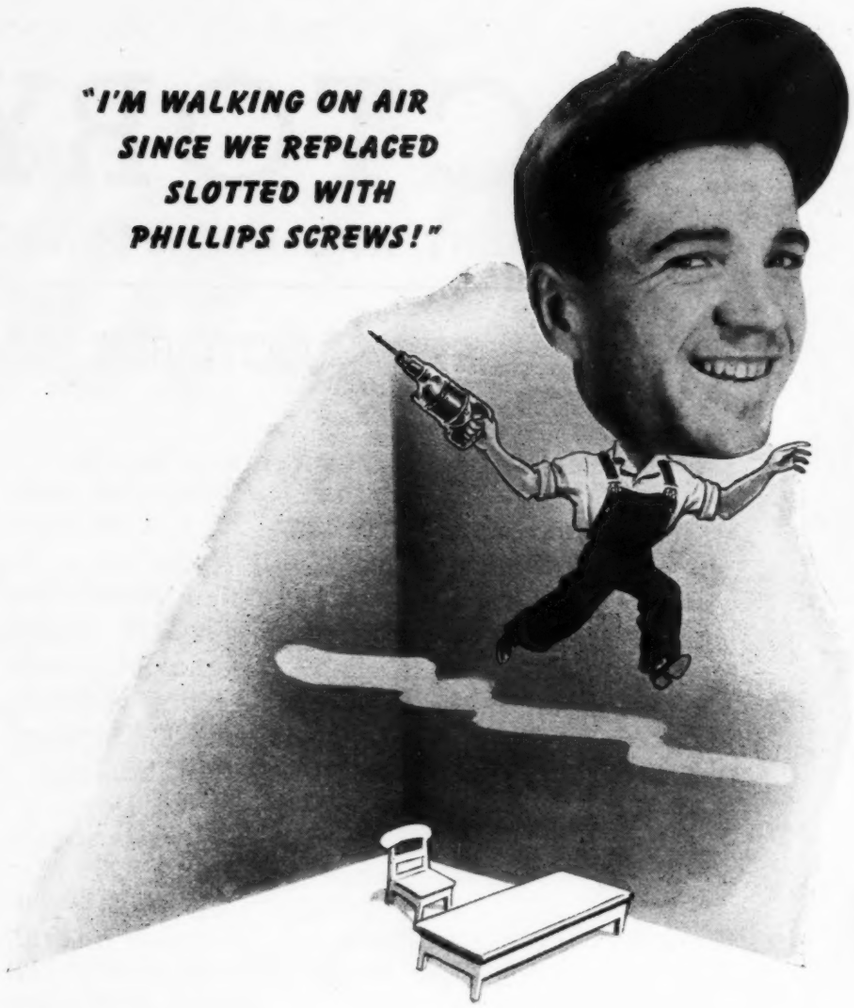
"I'M WALKING ON AIR SINCE WE REPLACED SLOTTED WITH PHILLIPS SCREWS!"



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Pheoll Manufacturing Co., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterbury, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

The Chemical Engineer cuts years to months...

Born in the turmoil of the last war, he is shaping a new world with mighty swords and magic plowshares

GERMAN CONSUL-GENERAL HOSSENFELDER, writing from New York on March 3rd, 1916, to von Bethmann-Hollweg, chancellor of the Imperial German Government, confidently predicted defeat for the United States because we were totally dependent upon the great chemical industry of Germany. "Americans," he wrote, "can never establish such an industry. They have the resources but they lack the necessary science and technology. And, besides, the conflicting selfishness of American business renders it impossible."

Even before the ink was dry on Hossenfelder's letter a new figure appeared on the industrial scene—the American chemical engineer. With the help of patient, but progressive and venturesome capital, he laid the foundations for the largest and most resourceful chemical industry in the world.

Today he is an all-important figure. For we are fighting a chemical war, even though the emphasis that is placed on planes, tanks, ships, guns and other armament tends to obscure that fact. And this chemical engineer is waging war for us on a prodigious scale. Bombers carry more tons of more deadly explosives because he has developed stronger and lighter alloys and more efficient fuels. Tanks are better armored and wield heavier blows because of products and processes born in chemical laboratories. Ships are welded together by new metallurgical techniques that save precious months over older processes. Gun barrels that are made in minutes instead of hours shoot farther and faster because of better ammunition.

And quantity keeps pace with quality. By mid-year of 1942, explosives were being produced in newly constructed plants twelve times faster than a year ago. Smokeless powder output has been doubled since December. Five times as much TNT was being made in July as in the months preceding Pearl Harbor. One single new plant produces more of this high explosive than did the entire pre-war industry—and several of these plants already are in production.

By what Major General William N. Porter, Chief of the Chemical Warfare Service, calls a "miracle of production," the sort of incendiary bombs that General Doolittle's lads showered on Tokyo were rolling out of our plants within a few weeks after we got into the war. As General Porter puts it, "they were rolling not by hundreds or even thousands, but by the millions." That record he has cited as a tribute to the "ingenuity, industriousness and patriotism" of the American chemical industries.

Yet the General agrees that we have only started to produce in the tremendous volumes that will shortly make Germany, Italy and Japan "revolve on their boasted Axis." Our newest plants are just coming into production. They face no limiting shortages of materials for, in the main, our chemical industry draws its strength from coal, salt, sulphur, limestone, oil, natural gas, coal-tar, air and water—all available in abundance.

We have heard little about the use of poison gas by our enemies. It may be that good reasons for this are stored away in our well-stocked chemical arsenals. American chemical manufacturers have worked hard and long with our armed forces so that if the time ever comes to make good on the President's warning of retaliation, America will be more than ready.

And defense against gas has not been overlooked. Every soldier is equipped with a most efficient type of gas mask, developed through twenty-five years of intensive research. The Chemical Warfare Service already is manufacturing millions of masks for distribution to civilians. Let us hope we may never have to use them. But if we must, we need have little fear of any gas or secret chemical.

This gas mask program has been made possible by a literal metamorphosis of production facilities, as peacetime industries have been converted to war purposes. A lumber company, for example, is making activated carbon from sawdust. Novelty manufacturers of rubber goods are turning out valves and assembling other parts. Former manufacturers of shirts, swim-suits, shoes and beds have converted their facilities and are contributing their share. More than eleven hundred contractors and two hundred and fifty sub-contractors are supplying their full quotas of chemical warfare materials. And production is right up to schedule.

But the bulk of the war job of our chemical industries has to do with items other than weapons and

ammunition. The German Consul-General, in that 1916 report to Berlin, said that many American industries were in a critical condition because of the scarcity of German chemicals. He related in particular that "the cries for help from the world of physicians are becoming louder and louder and more and more insistent." Thanks to our chemical industries this cry no longer is heard. Even though we are again cut off from quinine, camphor and some other strategic medicinals, our homes and hospitals are adequately supplied with synthetic products. Most of these are better and cheaper than the natural materials. The same sulfa drugs that have saved so many civilian lives in recent years have gone to war, with the result that deaths from infection at Pearl Harbor and Bataan are reported as surprisingly low. In this war we suffer no shortages of iodine and potash. Pioneering research in the field of vitamins has led to new industries that are contributing to health and better nutrition.

Those new uniforms the soldiers are wearing are of better quality and will last longer than the shoddy, ill-fitting outfits of 1918—thanks to sunfast dyes and new man-made products. And in the field of fabrics, nylon and the new rayons have gone to war in parachutes and super-strong cords for tank treads and tires.

* * * * *

And that brings up the question that 30,000,000 American motorists are asking with ever increasing concern. "When, Mr. Chemical Engineer, are you going to give us a set of new tires for the old family bus?"

That, I am told, is just what the chemical engineers have set about to do on a scale that is difficult to comprehend. In the words of Raymond Clapper, the columnist, "the synthetic rubber program for this year and the next is the biggest job of chemical engineering ever undertaken in the world." A billion dollar industry is being built at record speed to make almost a million tons a year of chemical rubber to serve our war needs and those of our allies. This cannot be accomplished overnight. Many months are required to design and fabricate complex equipment, much of which must be made from corrosion-resisting metals and alloys. We shall be lucky if a tenth of the desired capacity is in continuous production this year and even more lucky if, by the end of next year, the new industry should be turning out synthetic rubber at a rate of 875,000 tons—using both petroleum and grain as raw materials.

All this, of course, must go for essential military uses but there is reason to believe that in the laboratory and pilot-plant stages we have some promising substitutes and stop-gap materials that may tide us over until the big program starts rolling.

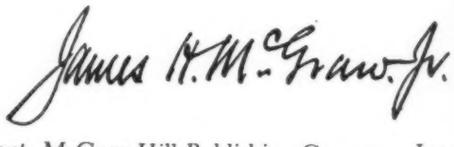
The present prospect of real success is possible only because of the cooperation of the chemical, rubber and petroleum industries. Individual firms and entire industries have set aside their normal desires and selfish interests to pool their patents, share their research and engineering developments for the common good. Synthetic rubber is here to stay as the basis for a great post-war industry: no doubt as to that lingers in the minds of the men who have seen many other natural products—indigo, alizarine, camphor, vanillin—all eventually fall before the ingenuity of the chemical industry.

* * * * *

In the coming peace to which we look forward hopefully, we shall find a new world full of new materials, new conveniences, new jobs, new opportunities, all stemming out of the present-day work of the chemical engineer. The same tough, transparent plastics that now make noses for bombers will give us new frameless windows for our homes and automobiles. With capacity to produce at least 2½ billion pounds of aluminum, which is five or six times pre-war production, and a magnesium capacity 50 or 60 times the pre-war figure, many new uses will develop for these structural materials of great strength and amazing lightness. Almost anything that flies, runs, moves, or otherwise is motive, will have a place for them. New fibers such as nylon and vinyon had scarcely got started before they were put to war use. Once the war is over they will be with us in greater abundance and at lower cost for a variety of uses so vast and so diverse that we can scarcely imagine them.

And the chemical engineer continues to create and to invent. He meets the challenge of scarcities and shortages with ever new "substitutes" that excel their originals. Even before the war is over he will have placed at our command a hundred new materials which we did not have before. His workshop is all industry. His contributions are as limitless as are our needs.

But right now his all-important job is to help win the war; to fight to a finish the ruthless and resourceful enemies that are devoting all their science and technology to bring about our defeat. So, as we take stock of our assets in this desperate struggle, we count among the first the proved resourcefulness of the research-minded chemical engineers we now have mobilized to help us fight this chemical war.



President, McGraw-Hill Publishing Company, Inc.

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FACTORY
MANAGEMENT AND MAINTENANCE

L · C · MORROW · EDITOR

Today's Public Relations Job

Despite the fact that the country is carrying on a war, industry must continue to work hard to keep itself understood by the public. Actions alone cannot do the public relations job. In fact, so many of the accomplishments of industry now must be kept under cover that it is next to impossible for the public to be extensively and accurately informed.

But with what ease the public is influenced by statements of indefinite meaning and appeals to wishful thinking! How important it is, therefore, to take advantage of every opportunity to tell the facts of the job industry is doing.

When the President said that we must double production, did the average citizen understand he was merely stating that it is going to require twice what we are producing now to carry on our share of the war? That is doubtful. Probably the usual impression was that our factories are doing only about half what they should. And that isn't so.

When the Kaiser cargo plane publicity was filling the papers and the air, did the average citizen have any way of finding out that the prediction of super-production probably was incapable of accomplishment? Did he have any way of knowing what are the bottlenecks in airplane production which prohibit the impossible, whether attempted by a builder of ships or a builder of planes?

When plant X curtails its operations to permit raw materials to be used elsewhere, will its employees and the public know that the action is taken to correct some detail of out-of-balance of the war program as a whole? And that such out-of-balance, justifiable in the beginning of our effort, is less and less so as we finish building our new capacity and get down to using it?

It is by means of our industries that the war will be won. Moreover, they are going to be all-important in the post-war period. Not only must they not be discredited, they must stand high in public esteem if the two jobs are to be done.

Nobody other than themselves is going to build up that standing. And if they succeed, it will be by the efforts of individual units, because there is no organization representing all industry.

The prescription seems to be the same old formula for public relations that was advocated in these pages in peacetime: Tell your employees as much as you can about what you and they are doing, and tell them why. Keep the local agents of information informed—newspapers, teachers, preachers. Participate in public activities, and in so doing dispense the correct data first hand.

There are certain qualifications: Stay within the bounds of censorship (which is looser for local than for national dissemination). Get there first with the information, which means don't wait until you are put on the defensive.

L C Morrow

Factory asked industry:

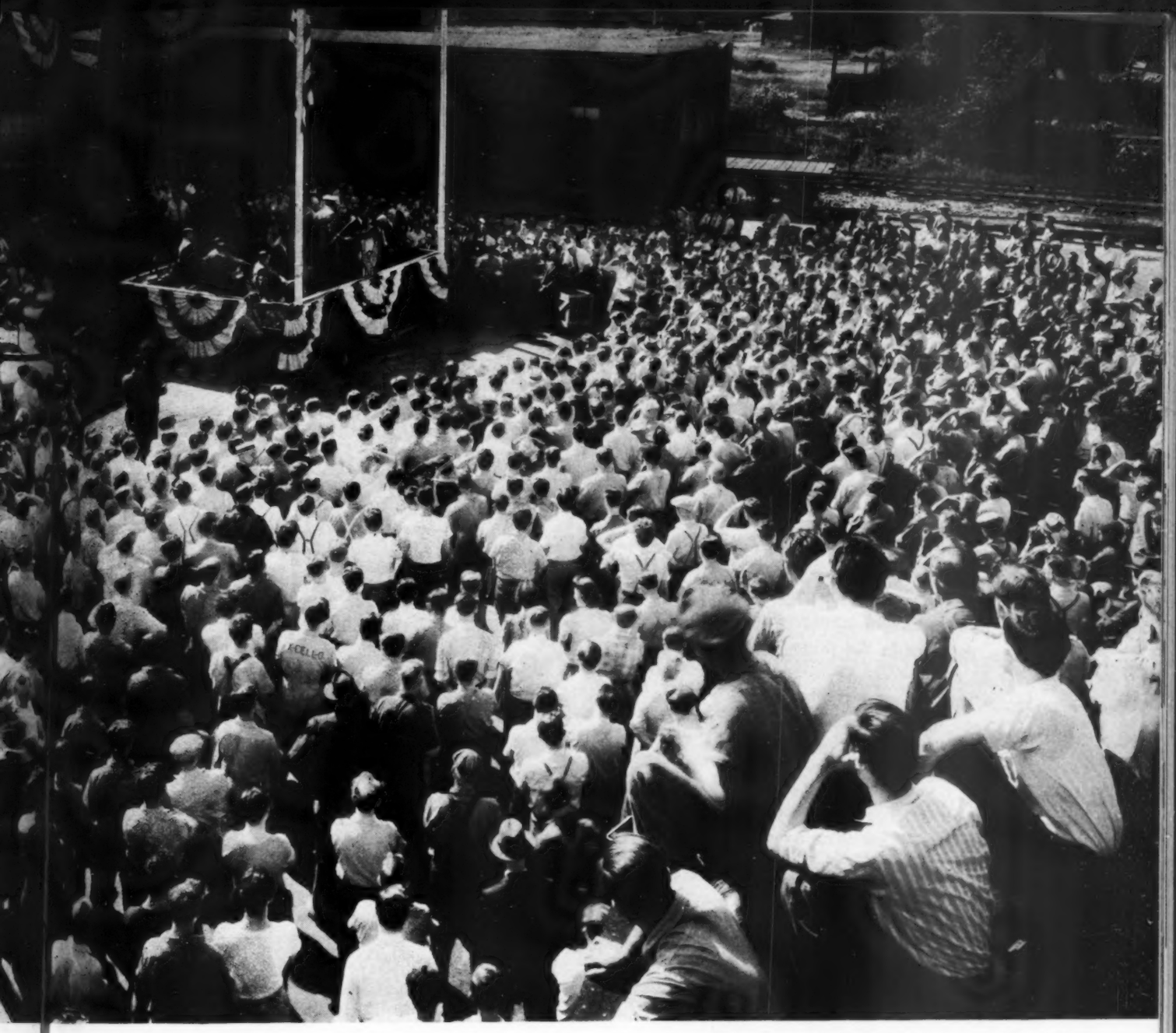
Are War Production Drives Worth While?

Countless techniques—for example, the sandbagged entrance at The Paraffine Companies, Inc.—have been developed by production drive committees to remind workers that they, too, are in this total war

SIX MONTHS HAVE PASSED since Donald Nelson hurled a challenge to industry which would have seemed fantastic in any times but these. Nelson asked the lion to lie down with the lamb. He asked labor and management to join forces in a War Production Drive.

Today it is fair to ask whether the drive has been successful, and to what degree, and whether it is on the downgrade or the upgrade.

In management's own opinion, it has been successful—amazingly so, in view of its unprecedented nature. And from Washington come reports that



Ex-Cell-O Corporation gets first bull's-eye flag awarded by Treasury for a war bond drive in which more than 90 percent of the employees participated and payroll deductions exceeded 10 percent

the movement, after slowing down for a time, has gained new strength and is surging forward again.

Management testifies that four out of five labor-management committees have been generally successful. This is the principal conclusion of a FACTORY inquiry, based on questionnaires returned by mail from 181 plants employing 405,634 workers. This represents a 15 percent "sample" of the 1250 plants in which WPB labor-management committees had been formed since April.

To clarify its own interpretations, FACTORY checked the questionnaire by means of a series of off-the-record personal interviews with management men in the East and Middle West. These interviews have substantially confirmed the findings of the survey.

No less than 84 percent of those returning the mailed questionnaire said "Yes" to the key question: "Do you feel that the drive sponsored by your committee has been generally successful?" Interviews show, however, that back of these answers lie many decided differences in degree of enthusiasm. "Moderate" would best describe the general tone of management's expressed approval of the drive.

On the other hand, it must be borne in mind that labor-management cooperation (the production drive's peacetime counterpart) has been a rare thing in the past. From this point of view, any substantial percentage of success, whether 80, 50, or 30 percent, can be considered well-nigh astonishing.

The several elements of "general" success, while difficult to evaluate, are approximately defined in subdivisions a to g of FACTORY's questionnaire (see page 76). Here, based on the answers, are the over-all measurements of management's opinion of the effectiveness

Factory's Survey Proves

How Effective Are Labor-Management Committees?

Will you help us compile a report for industry?

	YES	NO
1. Has your company a labor-management committee engaged in a War Production Drive under the plan of WPB's War Production Drive Headquarters?	181	
a. Were labor members (check one): Appointed by management___? Appointed by union officials___? Elected by employees___?		
2. If so, do you feel that the drive sponsored by your Committee has been generally successful?	138	27
a. In your opinion, has it improved the workers' sense of responsibility toward the war effort?	133	36
b. Has absenteeism decreased? (—%)	39	97
c. In your opinion, has it increased production?	82	67
d. Have you had any strikes since committee was formed?	10	152
e. Has labor tried to use the committee to usurp the prerogatives of management?	11	155
f. Aside from its work in the drive, do you feel the committee is helping improve employee relations?	125	34
g. How many suggestions have been received? ..... Adopted?		
h. How long has committee been in operation?		
3. If, in your opinion, your committee has failed, was failure caused by:		
a. Mistakes made in choosing labor personnel of committee?	13	___
b. Attempts by labor to usurp management's prerogatives?	5	___
c. Attempts by labor to force wage increases through the committee?	5	___
d. Other reasons (please state)		
4. Have you launched your own war production drive without a committee?	___	___
a. Do you feel that it was:		
— successful?	___	___
— moderately successful?	___	___
— not worth the effort?	___	___
5. If your plant has no WPB War Production Drive Committee, is it because:		
a. Morale and production were satisfactory already?	___	___
b. Labor was unwilling to cooperate?	___	___
c. The company didn't think it would work?	___	___
6. Has your plant received a Navy "E", or Army-Navy "E" award?	20	___

☆ *NOTE:* IF YOU WISH TO GIVE YOUR VIEWS IN GREATER DETAIL, PLEASE USE REVERSE SIDE OF THIS SHEET

Location of your company (State)..... Number of employees 405,634

Are your employees unionized? No-24 ...CIO? 82 ... AFL? 44 ... Independent? 30

FACTORY MANAGEMENT AND MAINTENANCE, McGraw-Hill Publishing Co., Inc., 330 West 42nd Street, New York, N. Y.

Production Drives Successful

84 percent of those who returned FACTORY's questionnaire say "Yes" to the key question: "Do you feel that the drive sponsored by your committee has been generally successful?"

78 percent believe that the drive has improved the workers' sense of responsibility toward the war effort.

71 percent, on the other hand, do not think that their war production drives have decreased absenteeism.

55 percent are of the opinion that production has been increased.

6 percent report strikes of some sort since the drives began.

93 percent find no evidence that labor has tried to use the committee to usurp the the prerogatives of management.

79 percent believe that labor-management committees, apart from their work in the drives, are helping to improve employee relations.

of labor-management committee in specific terms:

78 percent believe that the workers' sense of responsibility toward the war effort has been improved.

71 percent, on the other hand, do *not* believe that absenteeism has been decreased.

55 percent believe that production has been increased—although many respondents make it plain that this is solely a matter of opinion, hesitantly expressed.

6 percent report strikes of some sort since the drives began (yet half of those who *did* report strikes still believe that their drives have been generally successful).

93 percent find *no* evidence that labor is attempting to usurp the prerogatives of management.

79 percent believe that, apart from their work in the drives, the committees are helping to improve employee relations.

Further over-all findings reveal: (1) That 11 percent of the plants reporting have received Navy "E" or Army-Navy "E" awards—a proportion above the average, since less than 1 percent of the nation's total war plants have received such awards to date; (2) 53 percent of the labor members of labor-management committees were appointed by union officials, 24 percent elected by employees, and 23 percent appointed by management; (3) CIO held bargaining rights in 45.5 percent of the plants responding, AFL in 24.5, and independent unions in 17, while only 13 percent had no unions at all.

Made a Spot Study

To check up on the general accuracy of the questionnaire's returns, FACTORY conducted a detailed on-the-spot study of a single city—Cleveland. It should be noted that the success of Cleveland's war production drives has probably been well above average, because of strong support given to the movement by *The Cleveland Press*. This newspaper has taken the lead in stimulating interest in production drive activities, through frequent articles by Clarence E. Judd, industrial editor, and through other promotional activities in cooperation with management, union leaders and city officials.

Even after allowing for these factors, the Cleveland example demonstrates that any report indicating general national success for the War Production Drive is not far off the beam.

At the time of FACTORY's study, 47 labor-management committees had been formed in Cleveland between April 7 and August 31. Forty-seven seems a tiny proportion of the city's probable total of 1500 war plants, but it is impressive because these 47 plants employ over 70,000, or 37 percent of Cleveland's estimated total of 190,000 industrial war workers.

Only six of the 47 committees are known to have fallen by the wayside to date. Thirty-seven were still reported "active." No report was obtainable on four. A minimum definition of "active" is taken, in this case, to mean that the committees at least continue to meet regularly. It is probable that only about half of the existing committees are conducting or expanding really broad programs of activity. Yet the fact remains, and it would seem a noteworthy fact, that in these 37 plants are 47,000 workers engaged in some form of war production drive, and that a large majority of the managements and the workers involved have kept their confidence in the drives' essential objective.

This means that there is a strong basis for further extension of the

Aim of every production scoreboard is to record results from which workers may evaluate their own achievements. On the board at one of the plants of American Steel & Wire Company, an ingot rises with output, causing plane and tank to descend, finally driving the Axis pals off the face of the map

war production drive idea in Cleveland, and, inferentially, in other cities. Cleveland has a good chance to lead the way. It is the scene of a significant experiment, the Greater Cleveland War Production Drive Council, composed of representatives of all the city's active labor-management committees. The council holds meetings and awards certificates to "representative" industrial war workers. There is some prospect that, under encouragement of city officials, the council may open a headquarters, expand its activities, and become the first established municipal institution of its kind.

The Cleveland council's future is problematical, however. Some dissension arose in its ranks when several of the city's most prominent CIO leaders refused flatly to attend meetings presided over by officers who represented independent unions. To restore harmony, the officers in question resigned. The incident, however, disrupted elaborate plans for a Labor Day luncheon at which a prominent government official had been scheduled to speak. Independent unions, incidentally, are exceptionally strong in Cleveland, and are represented in seven of the active labor-management committees in plants employing a total of 20,000 workers.

Record of Failures

Do labor-management committees stand a better chance of succeeding in plants which have independent unions or no unions at all? There is some ground for supposing that they do. The record of committee failures reported in FACTORY's survey, shows a ratio of three to one between committees involving CIO or AFL unions and those involving independent unions or no unions. This is out of line with the affiliations reported in the returns on all committees. Here CIO or AFL unions outnumber independent unions and "no" unions only two to one.

The generally cooperative attitude of CIO and AFL toward the war production drive cannot be questioned, of course, for otherwise the drive would be a total failure. But there are additional indications that representatives of CIO and AFL find it difficult to check militant unionism at the door when they enter a labor-management committee meeting. For example, thousands of employees of one large company lost all chance to participate in the war production drive, because the CIO representatives refused to attend meetings unless they were paid for their time. No further meetings have been called.

It is perhaps significant that, in the few reported instances in which management felt labor was attempting to use the committees to usurp management's prerogatives, three times as many CIO and AFL members were involved as were members of independent unions or non-union workers.

Perhaps the most notable case of this sort occurred in Akron where, early in June, Local No. 5 of the CIO United Rubber Workers withdrew from the war production drive committee in The B. F. Goodrich Company, following a disagreement over their insistence that the committee should participate in decisions affect-

ing the deferment of workers from service in the armed forces.

To balance the record, the reader should be reminded that it was an independent union which refused to take part in an Army-Navy "E" celebration at the Kearny, N. J., plant of Western Electric Company, because, the union leaders contended, the company was undeserving of the citation. This incident occurred in the midst of a wage dispute which had just been settled, unfavorably to the union, by the War Labor Board.

There was evidence, both at Kearny and in Akron, that the majority of workers themselves did not sympathize with the actions of the union leaders. At Goodrich, the war production drive was carried vigorously forward by five management subcommittees after the major committee broke up.

Reported to Nelson

On August 5, the company was able to report to WPB Chairman Nelson that, during June and July, the production subcommittee had received 430 suggestions; the waste subcommittee 180 suggestions; and the safety subcommittee 154 suggestions; while the scrap collection campaign had netted 3700 pounds of tin and 15,700 pounds of scrap rubber.

War bond sales at Goodrich have been exceptionally successful, and a good start has been made by the transportation subcommittee on a share-the-ride program. The company has also named a full-time administrator to conduct its union-less production drive. In his report to Nelson, the administrator observed:

"It is interesting to note that labor is cooperating with management in these two (war bond and tire rationing) activities, even though they are not taking part in the war production drive as a whole, at present. In closing, we should like to add that members of the various subcommittees are composed entirely of management representatives, who are working hard and devoting many hours of their own time to this worth-while effort."

Does a committee have a better chance of succeeding if the members are elected by the employees themselves? An experienced observer of labor affairs pointed out to FACTORY, at the start of the war production drive, that election was the most democratic procedure, hence most likely to be successful. This was borne out by the returns to the questionnaire. The ratio of success to failure follows: Committees appointed by management, 4 to 1; committees appointed by union officials, 4.6 to 1; committees elected by employees, 6 to 1.

Similarly, "mistakes made in choosing labor personnel of committee" was the leading cause of failure in instances in which committees, in management's opinion, have been unsuccessful. Thirteen responses listed this as the principal factor, while five reported attempts by labor to usurp management's prerogatives, and five felt that failure was due to attempts by labor to force wage increases.

Additional instances underscore the dangers of attempting to launch a war production drive during any period in which a labor dispute is in progress. Two important companies reported to FACTORY that their drives had suffered serious setbacks because rival unions were contesting for bargaining rights in their plants. Neither management has lost faith in the production drive idea, however, and one, its representation question settled, observes: "We feel that the labor-management production drive committee will be of great value to the defense program."

Some Comments

Further search for the causes of failure yields these interesting, if isolated, voluntary comments:

"The efficiency committees are functioning pretty well as far as making suggestions is concerned. However, management will not spend any great amount of money in carrying out efficiency committee recommendations because labor (CIO) has frozen wage levels."

After describing in detail the course of a wage dispute, this respondent concludes:

"Perhaps after the contract is signed and the so-called tension is removed, the men may go to work. Management doubts it, but is willing to be shown. Nearly everything done by the war production drive committee has been done by management. All the labor members do is attend meetings after hours for which they are paid time and a half and criticize what management has done or failed to do."

An important feature of this case is the fact that the drive, when it began, produced "a 30 percent jump in dollars earned per productive hour" until the wage dispute began.

"Our production has been curtailed because of material shortages so that a committee to increase production had very little to work on," said another respondent.

This was the *only* instance in which a shortage of materials was reported as the primary factor in the failure of a production drive. One other company

HERE'S A FEATHER FOR Your HAT!
Thank you for your suggestion on . . .
It has been forwarded to the Suggestion Committee for consideration.
KEEP UP THE GOOD WORK!
PRODUCTION FOR VICTORY COMMITTEE

Biggest value from suggestion plan arises from building the desire to speed production. Red feathers in their caps distinguish Pabco people who have made suggestions, inspire others to get in the swim

listed this as a partial cause and inability to get sufficient contracts as the chief cause.

Another respondent, who feels his committee has failed, observes:

"Labor as a group is not ready for management chores, due to lack of training and experience. Give the best of labor a chance by education and practice, and the results will be easy to look upon."

Another looks upon labor-management committees as "political trial balloons, only the forerunners of attempted control of industry after the war." Another says bitterly: "Labor is not interested in anything patriotic."

Won't Spend Any Money

On the other side of the ledger, one respondent testifies against his own management as follows:

"The company I work for is not willing to spend any money in connection with this drive, even though the money is used for improvements and repair of its own property."

Yes, management can criticize management. Yet another respondent deplores what he terms his company's "hesitancy to give enough active participation to employees."

So much for failure and its causes. FACTORY has dwelt on the darker side in this report only in hope that some of the comments on committee failures may help others to succeed. Many pages could be given over to comments such as these:

"Two hundred percent increase in suggestions over old system."

"Believe it has helped very much in improved morale."

"Committee has rendered outstanding service in developing a greater war consciousness, promoting war bond sales, transportation plans, and salvage and waste campaigns."

And one respondent calmly reported an 85 percent decrease in absenteeism without elaborating on his statement in any way.

At all events, the over-all tabulation of the questionnaires is impressive evidence enough that something really significant and new is developing in industrial relations under the stress of war. If a strong undercurrent of mistrust, suspicion, and dissent still pervades many of these reports; if it is true that production is still being retarded by faults for which management blames labor (and labor blames management); then it may well be argued that industrial morale *does* need improvement and that war production drives deserve further trial.

Why, then, have relatively few companies undertaken production drives? Unquestionably the leading reason is that they consider morale and production satisfactory already. This is revealed in additional responses to FACTORY's questionnaire coming from plants where no drives exist. And it is worthy of note that many of these replies come from the type of company that has long maintained a scientific and extensive program of labor and public relations.

But personal interviews disclose also that this is not always the sole reason or even the real reason. The fact is that many managements are either hopeless or afraid—hopeless over an apparently bad morale situation or afraid of aggravating an already unhappy labor relations situation.

Against this, examples of managements that refuse to yield to any discouragement are fortunately numerous. None is more outstanding, however, than that of a company which faced these facts: Absenteeism more than doubled in a year of steeply rising wages; production held down by a union leadership which cannot shake off the old concept that restricted output, more money, and less work are labor's only goals; and a suggestion system which, in its first trial, yielded 400 entries, 75 percent of which were idle, frivolous, or selfish, and only 4 of which were acceptable. In the face of such discouragement, this management is working twice as hard to support its labor management committee and keep its production drive afloat.

Why? Because *it wants to get the war job done* and because it believes that when its employees do finally understand the seriousness of the war situation, they will pitch in and produce as never before.

Long Way to Go

Are production drives worth while? It is clear that they have a long way to go and a lot to accomplish. But it is equally evident that so long as a majority of the managements that try them have faith in them, their acceptance is bound to increase. This is borne out by the fact that 250 additional labor-management committees have come into being since FACTORY's survey was made.

No, war production drives are not a passing phase by any means. As a matter of fact, they are definitely on the upgrade.

58,500 POUNDS SCRAP PAPER
AVERAGE PER WEEK
HOW MANY POUNDS OF THIS SCRAP COULD HAVE BEEN SAVED?
WHAT CAN YOU DO OR SUGGEST TO REDUCE THIS WASTE ??
CONSERVE MATERIALS
PREVENT WASTE
THESE BALES Contain SCRAP for ONE DAY ONLY
CARBON SCRAP 23,500 Pounds (Average per Week) Equal to Weight of 1,000,500 SHEETS OR 104 MILES WIDE
PAPER SCRAP 33,500 Pounds (Average per week) Equal to Weight of 800,000 FORMS OR 91 MILES WIDE.

Uncontrolled waste can come close to losing the war, is something very tangible for labor-management committees to shoot at. Bales of scrap at Standard Register drive home the possibilities for saving

An expediter is not a foreman, not a check-up man, not an inspector. His job is to help, not to bawl anyone out. Here he and the foreman check blueprints on a job that has developed a production snag

Expediters Are the Cure for Production Headaches

Men don't wait for work, little mistakes and delays don't become big ones, when expediters are on the job. How Firestone beats production promises

SOMETHING NEW has been added at Firestone Tire & Rubber Company. This company maintains roving helpers called "expediters." An expediter is a man who travels from job to job and makes sure that each workman has the right tools—that the tools are cutting properly and without creating undue scrap—and that each man has enough raw materials to work with.

For 30 odd years Firestone had been making steel rims. Also, from time to time, such things as batteries and sparkplugs. This experience with steel gave it a toehold on one of the war's biggest and most intricate contracts—the making of gun-mounts for the Befors anti-aircraft gun.

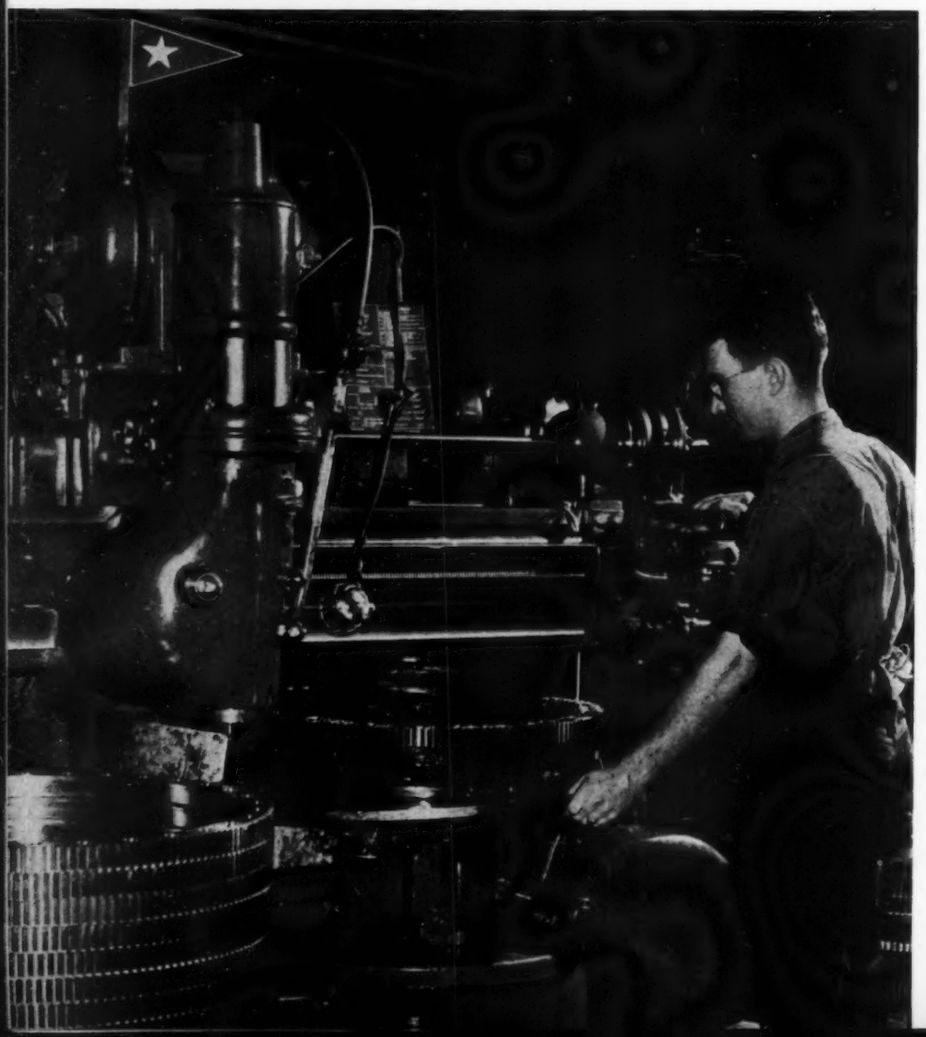
Assembling a working force of several thousand skilled and semi-skilled hands, out of a community of 250,000 which had few skilled steel workers, was no small task. There just weren't enough foremen and skilled mechanics to go around. Inevitably Firestone had to retrain tire-builders as far as they would go, and beyond that reach out and take average people and teach them the job. Unavoidably a few precious weeks were invested in showing these green hands how to do some comparatively simple repetitive task and get accuracy every time.

An expediter is a trouble-shooter. He is not a foreman, not a check-up man, not an inspector. His job is not to bawl anybody out, but rather to be an all-round assistant, a helper. His whole usefulness would be lost if he were the type of man who made people afraid to ask a question or to confess to making a mistake. Rather, the expediter earns his pay by finding out little mistakes and delays before they become big ones. He saves the company money by making sure that nothing has to be done twice because someone didn't quite understand directions, or ran out of materials, or for any other reason.

Because of these expediters Firestone is exceeding its contracts—is turning out finished goods much faster than anyone anticipated. The extra

Most of the time machines run smoothly, but even so, expediters keep in touch with the men, are nearby to give any needed help

The white flag on the top of the machine shows that this gear cutter is working 24 hours a day, 7 days a week, on war work



cost is an inexpensive investment. When men are held up because materials do not flow to them in the right quantities, overhead mounts and production slumps. So expediters not only cost the company no money—they also probably earn their own pay and show a profit. That is a cause for satisfaction, of course, because when the factory management at Firestone started this system it looked as if it were sacrificing output by taking good men off various machines and giving them this new and untried job.

All-round Specialists

Expediters specialize in the headaches and troubles of their own departments. An expediter in the barrage balloon department may spend 15 minutes helping a lad tie his sea-knots according to specifications. Within an hour the same expediter may be on his knees, helping to find out why a finger-patch doesn't cement down properly on the outside of the gas-bag. The next hour may disclose a small headache somewhere else—he never knows.

In the Bofors anti-aircraft department a young workman, earnest and careful, may find that a certain batch of metal does not cut as well as it has been cutting. Perhaps the weather is to blame; perhaps the cutting tool has dulled a trifle; perhaps some new wrinkle has developed which even a more experienced operator of that machine tool might not fully understand. Whatever the cause, the workman does not have to shut down and run for help. An expediter is at hand and can bring help. He may get out the blueprints covering that job and check the workman's procedure minutely. Or he calls the foreman and others to hold a clinic over the machine and see if something is wrong. The expediter has the authority to requisition whatever help is needed to solve any riddle promptly, because the one outstanding rule is that production must go on.

Incidentally, partly because of the success of the expediter system and partly because of better-trained hands—many of them homegrown—and a new willingness to cooperate fully for war production, more and more machine tools are now operated 24 hours a day, without a shutdown even to change shifts. Semi-automatic machines such as gear-cutters which cut gears for the Bofors 40-mm. anti-aircraft guns—gears to raise and lower the gun-barrel and revolve the frame at the touch of a handle—never cease

(*Continued on page 194*)

Looked Again for Scrap

First clean-up was just a starter at Carrier. Second brought in 2½ miles of old pipe, 250 tons of antique radiators, a similar pile of obsolete tools, jigs, and fixtures. So now the scrap hunt is always on. Here's how it's organized

G. H. ANGLIN, General Planning Superintendent and Salvage Manager, Carrier Corporation, Syracuse, New York

ONCE A PLANT has been cleaned up, it is profitable to go back and do the job over. For instance, in 1937 Carrier consolidated the operations of six plants into one large plant at Syracuse. This latter plant was completely cleaned up prior to the move, and we got rid of material from the other plants which was believed to be of no further use. Yet less than five years later we found that we still had 2½ miles of unusable pipeline on hand, despite the fact that we had taken out miles of pipe previously. We found in March of this year approximately 500,000 pounds of cast-iron radiators which had been made obsolete by the installation of a coil heating system! Another 500,000 pounds of obsolete metal tools, jigs, and fixtures have been disposed of!

Use of salvage equipment has been found extremely profitable. We recommend a magnetic sorter where there are great quantities of ferrous and non-ferrous chips from lathes and other machines. A centrifugal oil separator is desirable in the machine shop where steel is being machined, as the price obtainable for oil-free chips is much higher than that for chips contaminated by oil. Adequate barrels, drums, and other containers, marked with identifying colors, should be provided for every department.

Our program is carried on under direction of a salvage and scrap committee and a small tool and equipment conservation committee. It is necessary that these men have the knowledge and authority to determine what production material is not usable and what equipment can be scrapped.

Tinfoil from rolls of tape used to be crumpled and tossed on the floor. Not now. Before custodians of the master tool crib release a roll of tape, they carefully remove the foil. Their take—see the young mountain on the table—averages 15 pounds per week

Salvage Committee

This committee consists of a salvage manager and two assistants. The salvage manager has an intimate knowledge of our entire plant, buildings, equipment, and production material, gained over many years of manufacturing, planning, and production experience. One of the assistants has had experience with production and stock records and thus is able to check production material quickly against records, from an obsolescence point of view. The second assistant has had a thorough training in actual handling of scrap metals and is well qualified to supervise labor for such work as sorting metals or dismantling equipment.

The salvage manager meets daily with his assistants. As the management decides which production material is to be discontinued, scrap tags or inventory write-off tags are issued by the stock record department and turned over to the assistant salvage manager. He is responsible for seeing that the material is accumulated by materials handlers or storeroom men and sent down to the salvage repair department. There the obsolete material is sorted, classified, and prepared for sale, or examined to see whether it can be altered or used as another current or service part.

When changes are made in models, scrap tags are issued. These tags authorize removal of obsolete material from storerooms, from which it is sent to the salvage department for disposal. In this way we are able to get rid of

Another car of scrap iron is headed for the melting pot. In a second housecleaning Carrier rounded up 1,000,000 pounds of old metal

any material in our inventory that is obsolete.

Every Saturday morning the salvage manager meets with his assistants, the production superintendent, and the tooling engineer. They examine identified and unidentified equipment and machinery in storage to determine what equipment should be scrapped or re-used for purposes other than that for which it was originally intended.

When certain equipment is to be scrapped, it is so marked and then pulled out of storage. Records are made for the accounting department, and the material, where necessary, is dismantled to segregate ferrous metals, which are then sold to a regular scrap dealer. We have been successful in disposing of approximately half a million pounds of ferrous metals in four or five weeks by using this simple set-up.

Machinery that is to be sold "as is" is reported by the salvage manager to the assistant works manager, who notifies the WPB that the equipment is for sale.

Normal Machine Scrap

The salvage manager and his assistants make daily examinations of scrap containers throughout the plant to guard against contamination of ferrous and non-ferrous metals and to be sure that like metals only are kept in one container.

As a means of calling particular attention of production foremen and operators to the importance of keeping metal scrap segregated, chip barrels and skids are painted red, white, and blue, and stenciled with the name of the material. They also bear a department number and a simple slogan, "Help Win the War. Keep Scrap Separated."

The responsibility of removing scrap from production machines is given to the sweeping group, under the supervision of the plant engineer. The production foreman is held responsible, however, for frequent cleaning of the machines. Small hand magnets are furnished to the sweeping gang. The magnets are used to check the metals being put in containers, to make sure that only clean metal is put in the designated clean container. A certain amount of sweepings from the floor are inevitably contaminated. This material is kept in a separate place.

A daily report is furnished the salvage manager by any department in which contaminated material is found. The superintendent of that division and the foreman of that department are called in and this condition is called to their attention. In practically every case we get immediate cooperation and speedy action.

Salvage Repair

All material which is to be scrapped passes through the salvage-repair department with the exception of chips and flashing stock from machines. With three or four men, this department handles approximately 300,000 pounds of ferrous metals and 40,000 pounds of non-ferrous metals per month. Items such as fastenings of the expensive type, or brass fittings, are separated and where possible returned to our stores or offered for sale as second-hand material.

In the department we have a salvage lumber group which dismantles wood boxes. The lumber salvaged is re-used in our shipping department. This has proved to be a profitable operation, resulting in savings of approximately $5000 per year.

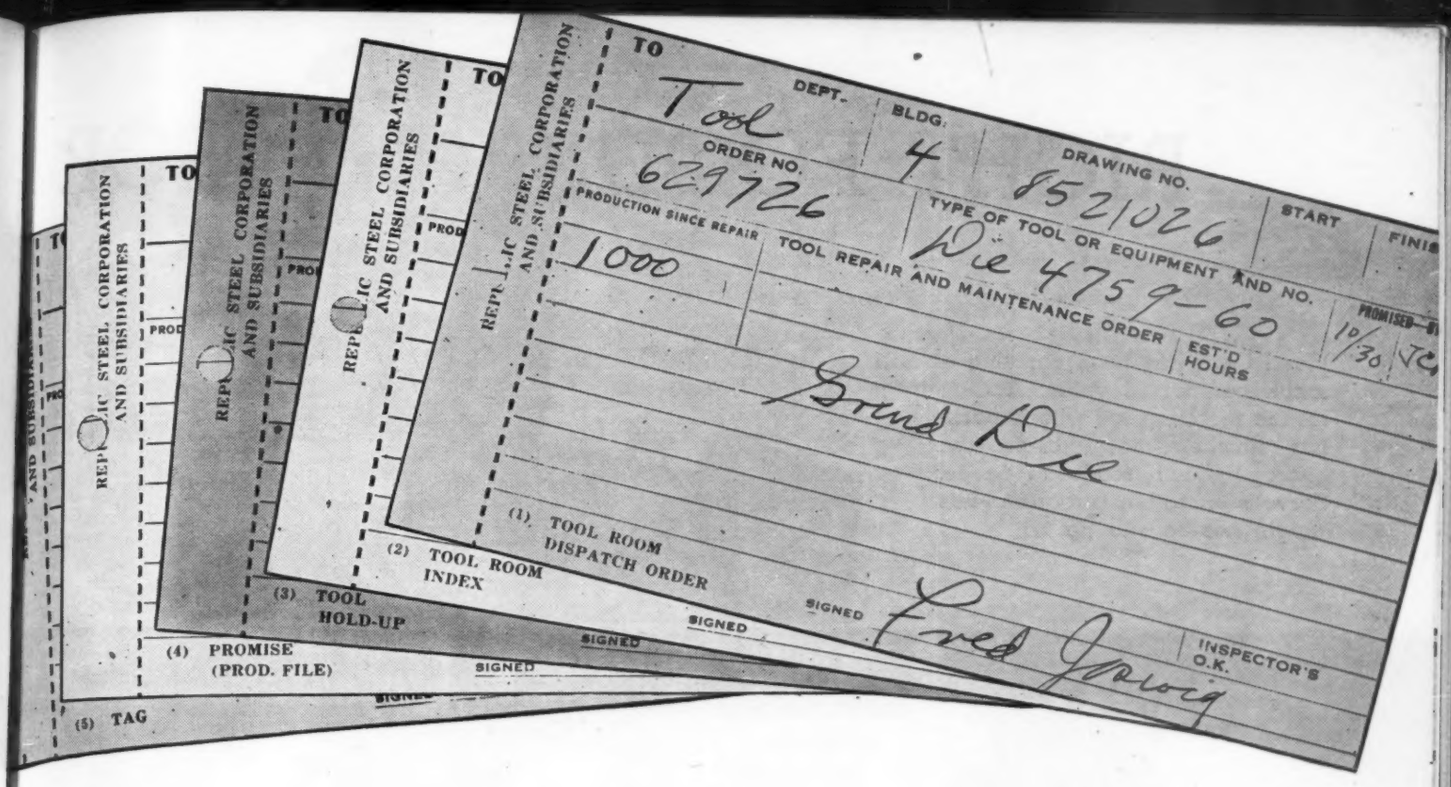
To conserve paper we have purchased a shredding machine. As most of our papers are of a confidential nature, it is necessary that they be shredded and cut up. After the paper has been shredded, it is baled and sold except for a small portion used to pack outgoing shipments. Normally we obtain sufficient packing material from our incoming shipments to take care of outgoing packaging. By providing fireproof skids, we have been able to obtain from our receiving department all the packing material necessary. Thus we have removed a possible fire hazard and provided ourselves with packing paper. We now have under study a proposal for using sawdust instead of paper.

Tool Conservation

Tool cribs are under the supervision of a member of the plant engineering department, who is also responsible for close checking of all replacement tools used in the plant. When a replacement tool is required, the foreman furnishes a requisition, which is signed and approved by the departmental or divisional superintendent. The requisition, together with the broken tool, is taken to the tool crib. A new tool is not issued unless the broken one has been returned.

The divisional superintendent is furnished weekly with a list of parts he has ordered, which gives him a close check on tool breakage. At the monthly budget meeting the tool expense is called to his attention, so that he has a constant incentive to keep tool breakage at a minimum. This simple program has been profitable and has reduced the number of replacements considerably.

To prevent purchase of duplicate tools, we require the men to turn in all their tools at the end of every fourth week. The tools are checked and if necessary re-issued. This procedure prevents us from accumulating a great many surplus tools in the various departments of the plant.



One Writing Controls Tools

Single form—with four carbon-backed copies—permits close control of tool repairs and maintenance, insures having tools, dies, jigs, and fixtures when needed

THOMAS M. LANDY, Industrial Engineering Department, Republic Steel Corp., Cleveland

ONE OF management's most perplexing problems is the control of tools. The WPB may declare a priority on the steel, aluminum, copper, or brass, but only local management can control tools. Without tools—no production.

Our control revolves around an efficient dispatching system and a form consisting of a green cardboard tag and four carbon-backed copies as follows: (1) Toolroom dispatch order (white), (2) toolroom index (blue), (3) tool hold-up, (4) tool promise.

When the tool (die, jig, fixture, etc.) needs regrinding or repairs, while an order is being processed, a tool repair order (see illustration) is prepared by the set-up man, inspector, or foreman.

The first, second and fourth copies are sent to the toolroom dispatcher. The fifth copy (tag) is attached to the tool and sent to the toolroom or outside tool contractor.

A promise date is posted on copies 1, 2, and 4, and the dispatch order is placed on the toolroom dispatch board. The index copy is placed in the tool promise file, filed by promise date and the tool promise copy is sent to the production office to be filed with the order papers.

The tool hold-up copy is turned over to the dispatcher in whose department the order is being run, and is attached to the order; the dispatcher indexes the order "Held up for Tools," and places all papers in the "Held up for Tools" pocket on the dispatch board.

When the tool is repaired, the tool dispatch order copy is returned to the dispatcher of the section of the plant where the tool went bad, as a signal that the tool is ready and that the order can be released from the "Held up for Tools" pocket.

The order is released, the tool hold-up copy is destroyed, and the dispatch copy is released to the production file as a signal to remove and destroy the tool repair copy in the production progress file. The index copy is retained by the toolroom as a record of completion.

The tag is wired to the tool which is returned to the tool crib, rack, or department awaiting it. The tag is then destroyed.

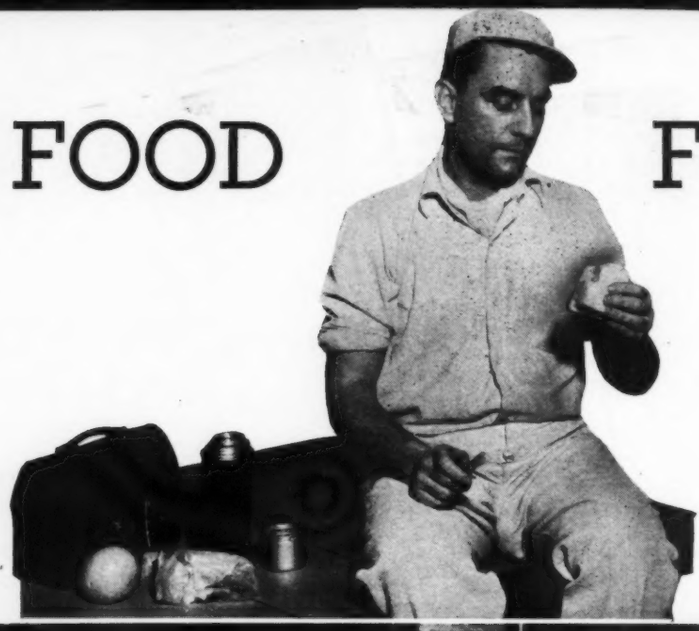
The dispatch and index copies are sent to the toolroom where they are filed with the tool crib record pending receipt of production order. The tool promise copy is sent to the production office to be filed with the hectograph master. The tool hold-up copy is destroyed, and the tag is attached to tool.

Upon receipt of an order, the tool promise copy acts as a notice to the production department to secure a tool repair promise before making promise to customer. The regular routine above is then followed except that the order is held in the dead load file until receipt of the dispatch copy from the toolroom.

If tools are repaired even though no order exists, the original routine is followed. One of the advantages of this routine is the fact that it permits working on tools not called for on current orders. This makes it possible to balance work in toolroom when work is needed.

A close cooperation between the production manager and the toolroom foreman makes it possible to render better promises as well as place active tools in condition.

RIGHT FOOD FOR



Lloyd Cecil has been carrying a lunch box for 20 years. Today, for the first time, his wife is packing lunches that contain the energy-building foods he needs. Servel's nutrition program has taught her how to do it

Above, nutrition committee plans cafeteria menus to conform with the government's national nutrition program. Cafeteria offers two balanced meals daily, both at lowest cost

Women, too, require good healthful food, are sure of getting it at Servel. "Victory lunch" costs 25 cents, consists of meat, vegetable, salad, bread and butter, and milk

WAR WORKERS

Pioneering experiment in employee nutrition at Servel has effected a 16 percent decrease in time lost through illness. This is since inception of the program four months ago, with comparatively few workers actively participating to date. Servel now offers a tested plan for all industry to use, covering home-packed lunches, menus in company cafeterias and neighborhood restaurants, and meals at home

LEWIS K. URQUHART, Associate Editor, *Factory*

NINETY PERCENT of absenteeism in America's war plants is caused by illness, not by accident. Ill health accounts for nine out of every ten cases of time lost in production—which totals 24,000,000 man-hours monthly. Time lost in one month (December, 1941) through illness would have built 2 heavy cruisers, 448 medium tanks, 3200 light tanks. Most workers normally eat nutrition-deficient or poorly balanced meals in their homes and at work.

Facts like these, gleaned from the findings of government agencies and other research groups, led Servel, Inc., of Evansville, Ind., to the conclusion that food is a controlling factor in war production, resulted in a nutrition experiment among its thousands of workers. Out of that experiment has come a tested program which is now ready for all industry to use.

Right Food for Victory

As one nutrition expert so aptly phrased it: "The number of planes, guns, tanks that come out of the nation's plants is determined by what the nation's workers put into their stomachs." Government officials, the medical profession, and industrial leaders agree that *correct nutrition for war workers will help speed production for victory.*

Under stress of longer hours, possibly higher working speeds, deficiencies in nutrition show up quickly in time off for sickness, loss of valuable man-hours, and slowing down of production. More than ever, workers need better food, properly balanced meals, and diets that build strength and stamina.

Proper nutrition means fewer and shorter illnesses; reduces fatigue and accidents; increases workers' efficiency; insures greater accuracy, less spoilage; improves worker morale.

War workers can buy a lunch for a quarter, or a somewhat heavier meal for 35 cents. Since moving milk up with the salads, near the beginning of the line, Servel reports consumption has doubled

Nutrition thus emerges the need of the hour, a potent weapon with which to combat ill health and boost production levels.

The problem of industrial nutrition is primarily the problem of industrial management. But the intensive, continuous program of education, which must be carried on among the workers to achieve lasting results, comes to roost logically on the doorstep of factory management. Right in the factory where workers work and eat is the practical place for effective action to be taken and followed through. In the factory is where *all* the workers may be reached *all* the time.

It was on this basis and with a deep-rooted sense of its own responsibility to do something about worker nutrition that Servel began the pioneering experiment which, in four months' time and with only a small percentage of workers actively partici-

PLEDGE of COOPERATION
*** As a contribution to the war effort, and in cooperation with the war plants of this community,
THIS RESTAURANT PLEDGES
TO SERVE FOODS THAT KEEP YOU FIT
in accordance with the Government Food Rules
SIGNED
COOPERATING WITH WAR WORKERS
MANAGER

Important step in raising nutritional standard of workers' diets is to get neighborhood restaurants to pledge cooperation

Nutrition booklet (left) tells workers' wives everything they need to know. It contains a guide to the foods that should go into every meal, suggests variety of lunch-box menus

pating, has not only materially raised the nutritional value of the workers' diets, but has also effected a 16 percent decrease in time lost from illness.

Servel's success with its nutrition program for its own workers has since led the company to develop it still further with the aid of material and studies made available by the National Research Council's Committee on Nutrition in Industry.

The present "Nutrition in Industry" plan has been developed in cooperation with the Nutrition Division and the personnel of the new Industrial Nutrition Advisory Committee of the Office of Defense, Health, and Welfare Service. It is specifically designed to help speed up war production by building the health of war workers through improved eating habits in the plant cafeteria, home-packed lunches, the plant neighborhood restaurants, and at home. It offers war plants, through local gas companies, much needed help in breaking the lost-time bottleneck caused by poor nutrition and illness.

To educate the workers to the need for following basic rules of correct nutrition, the gas company will help the war plant put on an educational campaign with health posters, folders, stories in the plant paper, buttons, etc., all keyed to the slogan: "Eat to Beat the Devil." Posters include official government nutrition posters outlining basic daily food requirements and specially designed action-getting posters. Other displays for the plant's cafeteria include posters and placards giving typical balanced mid-meals for both day and night shifts. Health folders and pamphlets containing practical, authoritative information on foods and nutrition are provided for distribution in pay envelopes.

In the Plant Cafeteria

Second step is to enlist the cooperation of the plant cafeteria, and here the gas company's home economist can help the cafeteria manager and chef plan low-cost, balanced meals. Similar assistance and advice are given the operators of plant snack wagons with the aim of raising the nutritional value of foods carried by them, with special effort being made to get wagon operators to "push" milk and fresh fruit juices.

The gas company will then assist the war plant in forming a committee to visit restaurants and lunchrooms in the vicinity and secure their cooperation in providing balanced meals for workers. Cooperating restaurants will be asked to feature "Victory lunches" and to display nutrition posters. Those measuring up to standards for balanced nutrition will receive a pledge of cooperation for display on the walls of their establishments.

The plan puts special emphasis on helping wives and mothers pack nutritious lunches for the war workers in their families, and to prepare balanced, healthful meals that will supplement those eaten on the job. For this purpose a nutrition guidebook with the title "Eat to Beat the Devil" has been prepared. It contains the official government food rules, a guide to the

Posters for display in cafeteria and neighborhood lunchrooms pound home the importance of fruit, vegetables, milk in the daily diet

essential foods that should go into every lunch, and suggested lunch-box menus.

Wives and mothers are also invited to visit their gas company where they can receive guidance in planning home meals designed to supplement the "on-the-job" lunches. Community classes conducted by the local nutrition committee at convenient neighborhood locations round out the family program.

Servel's own program—as previously stated, the "Nutrition in Industry" plan is based on Servel's actual experiences among its own thousands of war workers—stems back to a series of nutrition experiments with the families of four typical workers. These studies revealed that the home-packed lunch and the mid-shift meal were especially important.

Two basic balanced meals have now been established in the company cafeteria—a low-cost meal for 25 cents and a more liberal meal for 35 cents. A typical low-cost meal includes milk, beans, butter, enriched bread, cole slaw or salad, and fresh or stewed fruit. A more liberal meal includes meat, vegetable, butter, enriched bread, salad, ice cream, and milk. Every attempt is made to popularize these nutritious meals by making them appetizing and attractive. The whole psychology is to make the workers like what is good for them.

Among results to date, the Servel cafeteria is able to report a decided increase in the number of workers who select balanced meals. Soft drinks are rapidly being replaced by milk and fruit juices. Consumption of milk has more than doubled. Demand for fresh vegetables and fruits has grown to a marked degree. Salads, formerly almost untouched, are now a favorite. Above all, there is a new attitude toward eating. Most workers seem eager to get the daily required quota of vitamins and minerals.

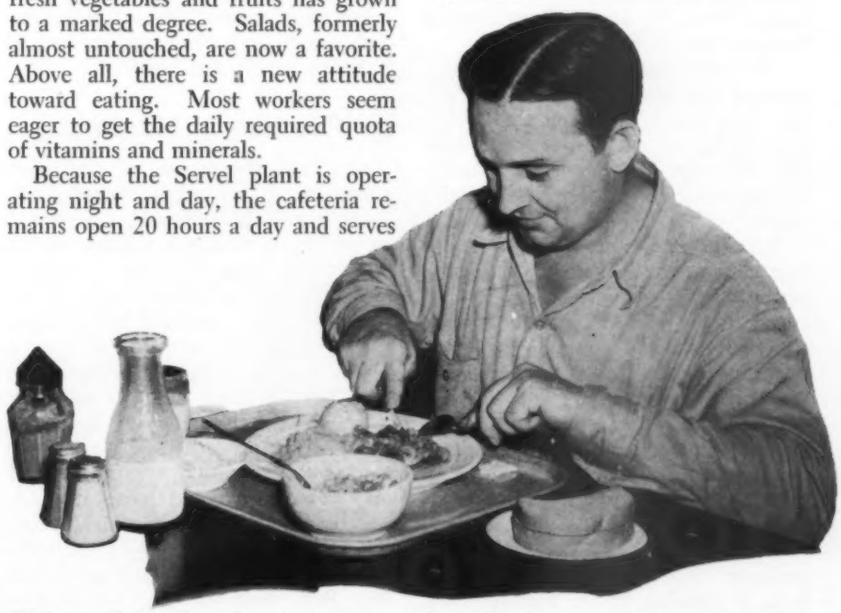
Because the Servel plant is operating night and day, the cafeteria remains open 20 hours a day and serves meals at 28 different lunch periods. More than 2000 meals are served daily. Kitchen space has been doubled. There is to be new dishwashing equipment and a separate room for dishwashing. New equipment includes pressure cookers and walk-in coolers. New trays, silverware, and tables have been set up.

Feature Milk and Juices

Real progress has been made in the training given to the operators of the snack wagons which tour the plant two or three times daily with fruit, sandwiches, hot and cold drinks. candy, and other foods to supplement the regular food of the workers. Operators are urged to feature milk and fruit juices; to date there has been more than a 50 percent increase in the consumption of recommended foods.

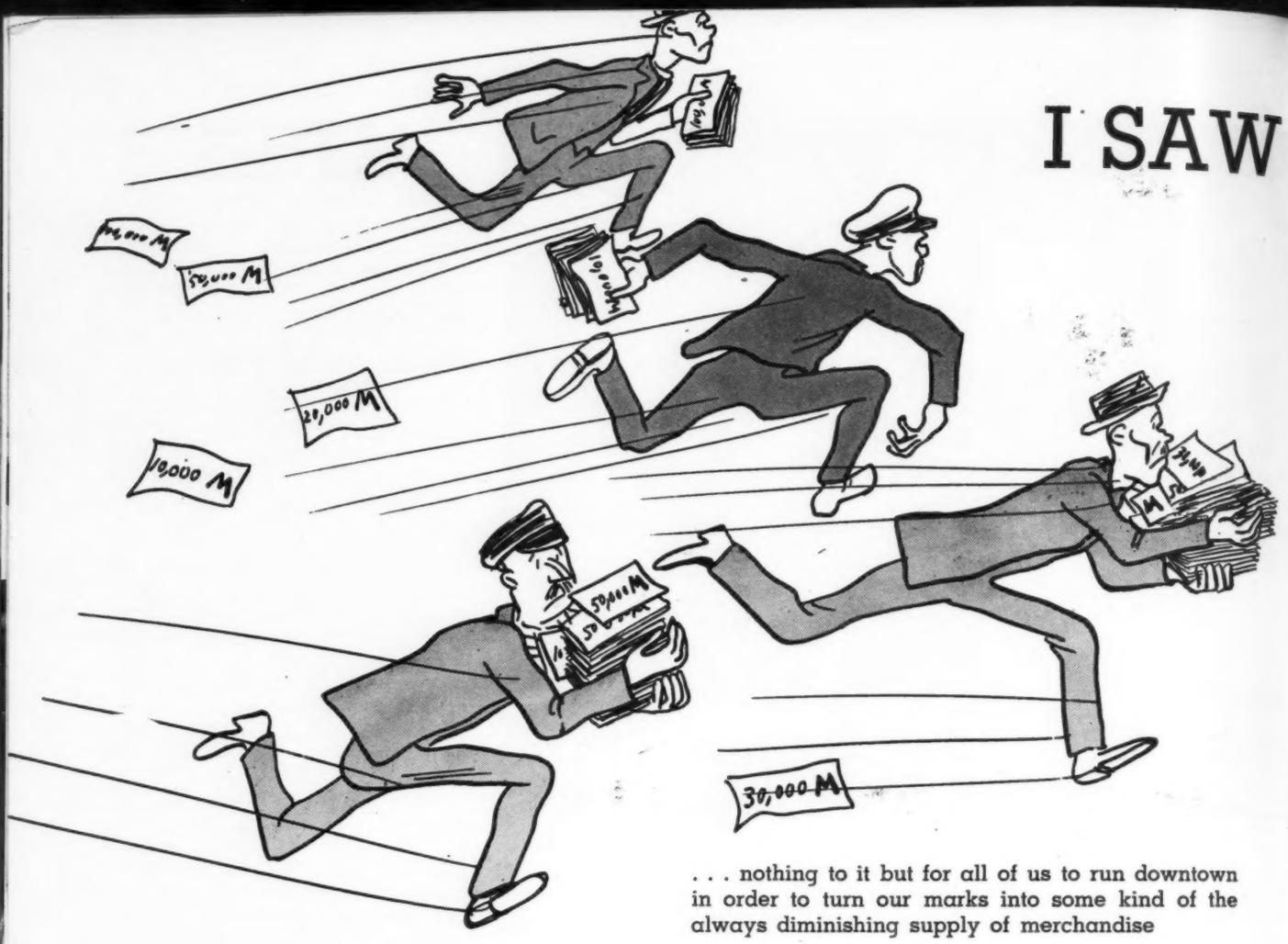
Progress is being made at Servel in the effort to get wives to pack the right kind of lunches—but the job is far from completed. A booklet tells what foods should go into the lunch box every day, and contains typical tested suggestions. Biggest problem is to get wives to break away from the habit of packing the same kind of food day in and day out, and to introduce more nutritious elements.

To help workers' wives prepare balanced meals at home, thus rounding out the food-for-health program for Servel employees, a nutrition guide and meal planner booklet has been provided. In simple, easy-to-understand form, it is based on complete menus used in the original nutrition experiments Servel conducted with workers and their families.



William Schindler digs into one of Servel's low-cost balanced meals

I SAW



. . . nothing to it but for all of us to run downtown in order to turn our marks into some kind of the always diminishing supply of merchandise

"WITH THE PRICE of everything doubling every few days," said a young coal miner down on the 2000-ft. level almost directly beneath Essen's great Krupp plant, "I can no longer leave the house of an evening because this is my last shirt!"

"At least you can stay at home," growled one of his companions, "but me, how can I even come to work? Last night my woman, in tears, tells me she can hardly make wearable for one more day this my last pair of *pants!*"

It is inconceivable that we should ever suffer here as wild an economic runaway as I witnessed and experienced as a Ruhr miner during the early fall of 1923. But all the same nothing except military victory is so much worth praying for here today as that our wage earner might realize how inevitably inflation, whether wild, tame, or in-between, tends to rob him not only of his social shirt but also of his working pants. Until he has had actual experience with it, he is certain to believe it nothing but a harmless academic abstraction, a bogey invented by a bunch of pantywaist economists for scaring ambitious people. Nothing but experience can teach him that this abstraction, harmless and attractive in its first stages, may easily bring the misery of a breakdown that is not only economic and social but also moral and political.

Testimony Meetings

Certainly the tempo of the wage-price spiral now acknowledged to have begun here would be slowed down if only a few hundreds of our labor and political leaders, also a few million of our wage earners, could somehow have contrived to sit in on those testimony meetings which my fellow miners staged throughout the working day there nearly a half-mile down under Essen. We were all, of course, supposed to be working on tonnage. So by our sweat with pick and shovel we could have added to our base or time-rate earnings of 10,000,000 marks per day—worth at the moment one single American dollar! But most of my companions had learned by sad experience that the extra millions thus added had too little buying power to be worth the effort. Accordingly, with our lamps between our knees, we sat in some black "room" or entry while one after another told just how the tragic spiral was hitting *him*.

"Pants I have and, thank the good God, one remaining street shirt," went on one husky member of the group as he took off the heavy wooden shoes in which he and most of the others regularly worked. "But look here! Do you see any socks?"

"Last night," put in another, "I saw a woman crying in a store. In her hand she had the fifteen millions for buying her man a shirt. The clerk was very rough. He told her he had nothing at that price. 'But you have! I saw it in the window!' she tells him. 'Exactly when did you see it?' he asks her. 'Why only this morning,' she says. 'Ha!' he answers, 'that's different. This afternoon that shirt went to twenty million!' And the poor soul, she just sat down and bawled like a baby."

"Without a shirt I could still work," testified another, "and maybe

INFLATION IN THE RUHR

WHITING WILLIAMS, Consulting Editor, *Factory*

without pants. But now I find I have no strength. You see, I can't buy meat, except maybe a small slice on Sunday and that's not enough."

"Me," added a companion, "I think I make money by saving on meat for buying me some tobacco. Because, without a small quid on my tongue, I don't feel at all like working—or even living!"

Figuring the Payroll

Did all this mean that there was no government machinery, no German version of our War Labor Board, for keeping the wage side of the spiral in some sort of balance with the price side? Not at all. Every Thursday night the local coal operators, in order to calculate the week's payroll, applied against Monday-Thursday's reported hours and tonnages the figure supplied by Berlin as the week's official "multiplier." The trouble was that the ponderous government machinery could not work fast enough. By Friday night when we got the multiplier's tens of millions in our hands, we were 24 hours behind. There was therefore nothing to it but for all of us to *run* downtown in order to turn our marks into some kind—any kind—of the always diminishing supply of merchandise. And nothing—no thing—could possibly be so useless as not to be worth more next morning than any money we might have still in our pockets.

The marvel was that any merchant of food or other commodity would bother to sell it. Sitting one day in an Essen drugstore, I was impressed with the social conscience that kept the proprietor at his post. Mostly he sold little needfuls. More than a few gaunt old women would inquire about some simple health necessity, listen to the price as to a death sentence, and then turn silently away.

"Neither I nor my supplies can stand it much longer. Every day I take in hundreds of millions—to lie here in the drawer and become worthless. To go out and bring in more stock means to close my shop—and, as you can see, my neighborhood needs me."

Few could afford the luxury of following so conscientious an example. All around him the decay of money values had brought with it a decay in morals. Because wages just could not be kept level with prices, many a father saw his children grow hungry and soon thereafter figured it a virtue for him to become a thief. In spite of the town's numerous but inadequate vegetable plots, no farmer could hope to find even the greenest of his potatoes in the ground of a morning unless he sat up all night to guard them—or dug up the precious tubers and fed them to his pigs. And, with winter coming on, no owner of a coal pile could expect to keep it without continuous watching. As a matter of fact, with economics and morals so badly balled up together, an observer could only wonder whether the baker should not have laid aside his conscience before he laid down on his job and put in his window the sign that announced: "Because I can get no coal, I have no bread to sell today."

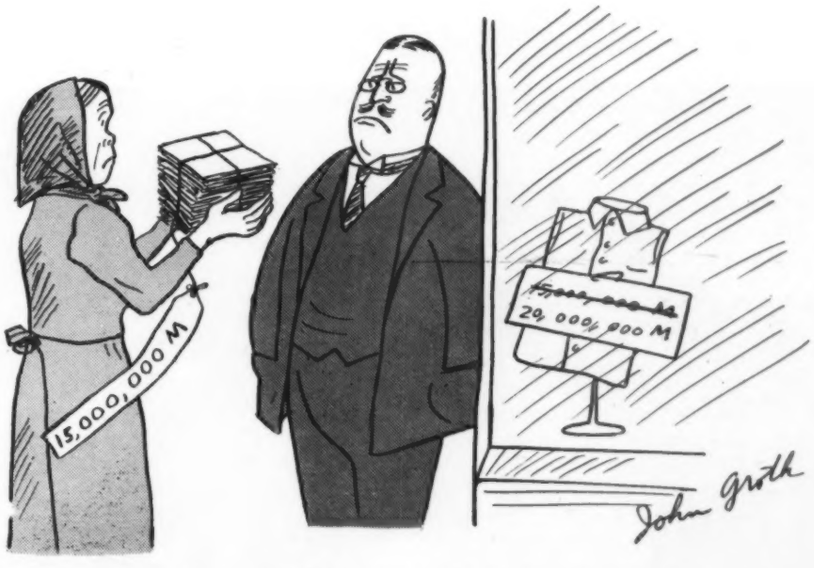
Plainly enough, once the economic runaway gets really going, every department of working or living must somehow make adjustment to it—or lie down and die. Potatoes, bread, and coal—it is the expectation of receiving these tomorrow in exchange for and in the measure of today's muscle and sweat that makes organized society possible by supplying the necessary cement, and then makes that society a going concern by supplying its mainspring. Because that ultimate binder and mainspring is a matter of expectation, it is also a matter of faith and morals. Because it has been found useful to simplify that binder and that expectation by means of the handy expedient of money, the moment that expedient is, for any reason, found no longer a reliable guarantee of tomorrow's food and warmth in return for today's labor, then arms, stomach, mind, and heart are likely to unite under the banner of "To hell with tomorrow!" in a rebellion against the decrees of conscience and government.

Naturally enough, accordingly, the Ruhr's trouble with bread, potatoes, and coal above ground brought forth amongst us below ground much discussion of religion and politics.

The More They'll Want

"What good does it do us?" so one burly fellow put his finger on a specific uncertainty that vastly weakened the peace plans worked out at Versailles. "What good to work our heads off digging coal for the reparations when our enemies refused to specify the total we must pay? The harder we dig, the more they'll demand!"

(*Continued on page 198*)



"This afternoon that shirt went to twenty million"

New Subsidy Plan Solves Ride-to-Work Problem

Buses and streetcars, subsidized by Lockheed and offering convenient express service to war workers, have already retired 5500 employee automobiles. Other companies in Los Angeles area are following suit. Plan meets small plant needs

BY SUBSIDIZING public transportation for employees, leading war plants in Los Angeles are moving rapidly toward a real and lasting solution of the rubber problem.

Lockheed Aircraft Corporation began experimenting with the subsidy idea early last March. Since that time, chartered buses have retired more than 5000 cars for employees of this concern. Production has been increased. Safety standards have been raised. Morale has been improved.

The Lockheed example is now being copied widely by other plants. Indications are that before the end of the year a sizable percentage of the city's war-industry workers will be moving to and from work in chartered streetcars and coaches. This mode of transportation is being made so desirable and so economical that the difficulty of selling employees on the idea of putting up their own cars has been minimized.

Experts are agreed that Los Angeles has one of the most difficult transportation problems in the nation; that fact led Lockheed to pioneer the idea of subsidized riding. The city covers some 450 square miles. Major war-material factories are scattered from one end of that vast area to another. Employees' homes are even more widely dispersed.

Many workers who live in the San Fernando Valley or the foothills work at the Douglas plants in Santa Monica or Long Beach, or in the shipyards in the Los Angeles harbor area—distances of 30 or 40 miles. Numbers of Lockheed employees, on the other hand (Lockheed is in the Valley) come from points near the Beach. The average employee, a Lockheed survey showed, lives 10.6 miles away from his job. Only 20 percent of the workers are situated within 5 miles of the plant. Some 110 Lockheed people come from San Bernardino County, driving distances that range from 57 to 78 miles each way.

Manufacturers have attempted to rectify this condition as far as possible by exchanging workers. A special aircraft committee has been set up for this purpose. But that procedure can go only so far.

Another complicating factor in the situation is a relative dearth of public transportation. Because the climate is pleasant the year round and ground is plentiful, people have built homes in inaccessible spots and have established a habit of spending much of their time outdoors. For many years, lots of Angelinos have practically lived in their cars.

The *per capita* ownership of private automobiles in Los Angeles is greater than in any other city in the world, running about 1.2 per family. And *per capita* usage of cars is several times that found in most Eastern cities. Until the war started, more than 80

Right, chartered coaches wait for shift break at Lockheed. Three public carriers provide low-fare service from eighteen railheads

Below, war workers throng transportation bureau in their eagerness to get full information concerning the new chartered bus service

Subsidized transportation in buses and street cars is being made so desirable and so economical that it has not been hard to sell war workers in the Los Angeles area on the idea of putting up their cars for the duration. Here, a shift break at one of the Lockheed gates

percent of the city's travel was by private car.

All this has retarded the growth of public transportation systems here. The transit companies could not get enough business to offer complete coverage and fast service.

Two difficult problems were posed:

1. A method had to be devised for making a limited amount of transit equipment do a big job.

2. War-industry employees who have always driven their own cars had to be sold on the idea of using public transportation.

City-wide adoption of an hour-staggering program, which makes a large number of buses available for special service at the war-plant shift breaks, licked the first problem. The second has been solved by making public transportation as economical as unit transportation, and more convenient.

Absorbs the 20 Percent

This is where the subsidy comes in. Lockheed found it was impossible to hire transit equipment for special service without charging the employee about 20 percent more than the cost of his gas and oil. So the company decided to absorb that 20 percent.

On this basis there was something to offer the worker. He could ride without extra expense. He saved the labor of driving. He saved his tires. He could get to work just about as fast on the bus as in his own car.

Lockheed therefore arranged with three carriers to provide fast bus service from eighteen railheads directly to its plants, the coaches operating at three shift breaks. Cost of the service is 20c. per mile plus $1 per hour per coach. Cost to the company is only a little over 29c. per man per month.

As the service increases, that cost will eventually be defrayed by savings in parking lot expense, according to Personnel Manager Robert Storment who fathered the plan. Since Lockheed has never been able to provide parking space for all employee cars, the pay lots are going out of business first. But eventually company parking lot costs including ground, lighting,

Subsidized riding works like this: Plant sells tickets at flat rate. Transit company is paid once a month on the basis of miles traveled and hours used, plant making up the difference in cost

maintenance, and use of space for additional building will mean a saving of full 40 percent.

Other advantages are these:

1. Reduction of parking congestion will minimize an accident and air-raid hazard. Experts say the jam at a shift break here formerly compared in size with the ones that follow Rose Bowl football games. Today this jam is already breaking up 14 minutes earlier than before.

2. Department heads report that employees who ride to work are definitely more efficient than those who drive.

3. The employee tendency to "edge toward the gate" a few minutes before quitting time in an attempt to beat the other fellow to the parking lot is minimized.

4. Employees do not have to make a long drive in heavy traffic at the end of a hard day's work, are thus fresher for their hours at home. General morale is consequently raised.

Lockheed experience proves that with proper hour staggering a lot of men can be handled with little equipment. Only 54 buses—of 30-passenger capacity—working 50 hours a week have been taking care of 5500 men. The company has just completed a contract with the public schools for use of 27 coaches of 72-passenger capacity, which will take care of another 3500 men.

The next step is to move the start of the day shift from 7 a.m. to 6. With downtown business houses not opening until 10 a.m., this allows a 4-hour leeway, which will make available about 225 additional transit company coaches. With 300 coaches serving three shifts, it will be possible to transport something over 30,000 men to and from their jobs.

Mechanics of the plan are simple. The factory sells tickets to employees at a flat rate of so much per book. The transit company is paid once a month on the basis of miles traveled and hours used, Lockheed making up the 20 percent not paid by workers.

Smaller manufacturers in Los Angeles are adapting the subsidized transportation plan to their needs by cooperative action. If a plant does not have enough employees to justify the transit company's making special buses available, that manufacturer is asked to form a committee representing other nearby plants. That body surveys the needs of the district as a whole and makes a joint request to the public carrier.

The procedure is for each small manufacturer in the area to prepare maps and charts showing how many employees he has, what hours they work, and where they live. Analyzing these data, the bus or streetcar company suggests that the several firms get their hours together—at a time when transportation equipment is not in use elsewhere.

In some cases the plan has made it possible to get 20-min. streetcar service up to 2 or 3 a.m. In others it has permitted the chartering of several buses for each shift—enough equipment to handle all the men who need public transportation.

Cost of this service is prorated among the manufacturers according to number of people served. Each member of a cooperative charter group is issued tickets of a different color. At the end of the month the streetcar or bus company counts the tickets of each color redeemed and bills the individual plant for its proportion of the total charge.

The amount of cost being absorbed by manufacturers varies from plant to plant, but runs fairly close to the Lockheed standard of 20 percent. The important thing is to get cost down to about the same level as that for use of a private car, remembering that the average employee considers his gas and oil as the only real item of operating expense.

"SWAP-RIDING NOT ENOUGH"

Amendment No. 16 of OPA's Tire Rationing Regulations provides: War workers will not get tires unless their plants have organized transportation plans. A worker in a given plant may be certified to his local rationing board if he promises to use his car every day, and if the workers who ride with him cease using their cars to go to and from work. See details of the amendment on page 256

How We Retrained 900 Men Every 60 Days

Problem: to switch men from auto bodies to plane parts in "nothing flat." Two-man teaching teams, job specifications, and training on the job turned the trick

H. J. ROESCH, Director of Industrial Relations, Briggs Manufacturing Company, Detroit

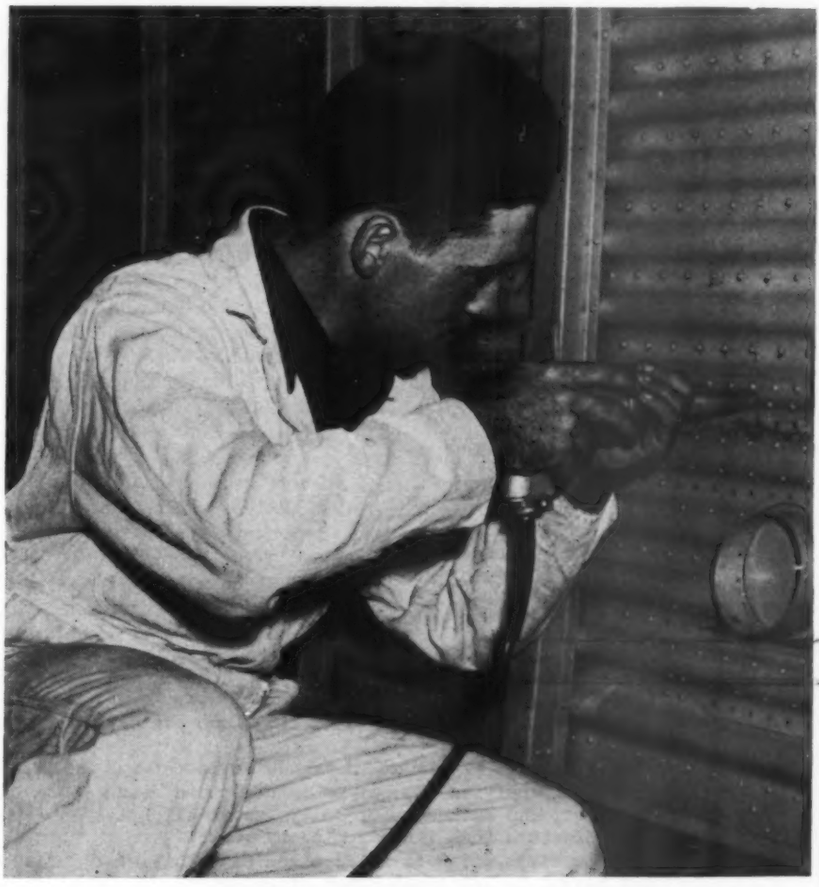
ALTHOUGH we had a group of workers experienced in sheet-metal work for automotive bodies, the problems involved in handling and working with aircraft materials are so different that we had to train several thousand workers within a few months' time. The formulation of plans for this training began in April, 1941; by June this part of the program was completed, and instructors were hired in July. On August 15, the first students began training, and before the end of the second month workers skilled on specific jobs began entering the shop to work on the expanding production.

No More Automobiles

At the beginning, it was assumed that regular automobile production would continue and that airplane subcontracting would be added. Workers from the outside were therefore hired to take this training. When it became evident that automobile production was to cease, the training problem became one of retraining workers experienced in one field of metal forming and assembly to perform the same general operations in an entirely different metal—and with much more precise limits.

We began to train workers on the job in the shop. In fact, the first thousand were trained on the production floor. Although instructors were available, it quickly became evident that this was an incorrect method; when a trainee was added to a group of regular workers the output dropped.

To begin with, the training was for specific jobs; it was not an extended apprentice course. A vestibule school with 60 instructors operated on a three-shift basis to provide the necessary 400 hours of training for 900 workers each 60 days. But in this school the trainees worked with the actual production fixtures and tools they were to deal with when they got to the production floor; furthermore, except for a test-plate problem which will be described later, little material was scrapped because training work was done upon parts that went into the regular production and passed the regular inspection standards. In this way no transfer of thought and no new coordinations had to be made when regular work was begun on the production floor.



Essence of problem was how to retrain men experienced in one field of metal forming and assembly to perform the same type of operations in an entirely different metal. Here a trainee learns by doing a bit of repair work. He is drilling out a bad rivet in a fuel tank door

Any training program may be broadly divided into: (1) Selection and training of instructors; (2) selection of workers to train; and (3) methods adopted to accomplish the actual training.

People will work more interestedly —and better—if they know why certain things are done in specific ways. Why, for example, should an aluminum rivet be preheated, quenched, and then refrigerated before using? To furnish technical information of

this sort, two instructors with different backgrounds were teamed to handle each group of 30 trainees. One of this team was a graduate engineer with a knowledge of metallurgy and strength of materials; the second, a practical man from our shops. The first supplied the necessary technical answer; the second imparted skill of eye and muscle. This happy combination helped enormously to increase the tempo of the training and to reduce scrap because the men knew the why of certain moves.

It is evident, perhaps, that these instructors needed instruction before they began with their trainee groups, because working with aircraft materials was new to them. The two-man teams, therefore, worked through courses in drilling, riveting, metal forming, layout, sheet-metal repair, and welding.

A period of four weeks was required for this training under the instruction of our engineers who had spent a great deal of time in the plants of our prime contractors. In addition, training was given in how to teach, but since that took the familiar form —tell, show, observe, check—it need not detain us here.

When this stage of the instructors' training was completed, they—still the team of two—were required to write up a complete specification for the specific job they were to teach. This was done with the production fixtures and the productive materials used on the production floor, for remember this is the way the workers were to be trained.

Eventually these specifications of exactly how a particular job on a wing section, for example, was to be done were combined into a job specification book listing every detail move which the worker must make, and showing, in addition, a picture of a knack in movement or method which might be difficult of word description. These word and pictorial descriptions were grouped into booklets covering a related set of operations. No illustration can be given because of the nature of the information, but a work specification (see exhibit) for a faceplate problem used in worker training will serve as a partial indication of how this information is assembled.

Next came the selection of workers to train. With delicate material to form, drill, and rivet, a sureness of touch and a dexterity in control were required to benefit fully and quickly from the training which had to be given to the applicant.

Aptitude Tests

Following the ironing out of seniority problems with the union, operators from the body plants were given a series of six tests to determine whether they had the sureness, dexterity and knowledge to grasp the training in the time required:

1. Dexterity and muscle coordination. A number of rivets are moved from one zone on a board to corresponding holes in another zone of the same board. Grade on time required.

2. Use of scale and snips. Lines 1 inch apart are drawn across a piece of 6x8 stock. Snips are used to cut along the lines. Grade on accuracy of layout and ability to cut on the lines.

3. Use of file and combination square. File a piece of stock slightly over 2 inches square to 2 inches. Grade on time and accuracy.

4. Visual perception. Fifty rivets of varying diameters are sorted according to diameters. Grade on time required.

5. Ability to read micrometer. Ten settings are given the applicant; he must tell the readings immediately. Grade on number of correct answers.

6. Ability to deal with fractions. Ten questions on manipulation of simple fractions are given.

These induction tests uncovered a group of likely prospects; they were given to all who entered the school and had to be passed with a satisfactory grade. But this was only the first hurdle. The first two weeks in the school constituted a pre-training period in which aptitudes and abilities were checked closely by the instructors; if unsatisfactory, the applicant was returned to his regular job. At the end of this period of the applicant had to build a test plate within a limit

(*Continued on page 204*)

FINAL ASSEMBLY OF TEST PLATE
as per print BE-1001

1. Study print carefully.

2. Get rivets as specified.

3. Get tools.

2 X rivet gun and hose	Dolly bar
1/8" round head set	3/32" drift
3/4" swivel set	Cleco pliers
Masking tape	

4. Rivet splice plate (-1) to base plates (-5) with bucktails on same side of assembly as gussets.

   (a) Put in center rivets first, working from center to outer edge.
   (b) Hold rivet gun firmly at 90 degree angle to material, applying gun-set to manufactured head of rivet, and bucked up by dolly bar at slightly less pressure than that applied by gun.
   (c) Hold bucktail width to 1 1/2 times rivet diameter and height to 1/2 times rivet diameter.
   (d) Remove clecos as rivets are driven.

5. Rivet frames (-4) then (-1) to main plates at center holes not covered by gussets.

   (a) Repeat procedure in 4b, 4c, and 4d.

6. Rivet gussets one at a time, starting at inner corner and working to outer edge.

   (a) Caution - guide and hold rivet gun with one hand at gun grip and one at gun-set.
   (b) Remove remaining clecos as rivets are driven.

7. Check completed job.

8. Final inspection by instructor.

Budget Gives Profit Picture in Half a Minute

A 30-second look at the monthly report is all that's needed to put the finger on the exact reason for a variation from the amount of profit forecast

R. J. RAHN, Vice-President, The Stanley Manufacturing Company, Dayton

GET OUT YOUR WATCH and time yourself while going through the few steps our president goes through in the brief study necessary to locate profit variations.* Ready. Go!

Look first at Figure 1, showing the greeting card division. In the center group of columns headed "Profit," you will see that the budgeted profit for March was $12,167 and the actual profit was $12,646, an increase of $479. So, as a whole, the profit in the greeting card division is satisfactory, although there are some other details requiring attention which we will go into later.

Now look at Figure 2, showing the label and nameplate division. In the "Profit" columns you will see that the budgeted profit for March was $10,000 but the actual profit was only $7836, a loss of $2164. Following this same line to the right, in the group of columns headed "Profit Variation Due to," you will see a "Standard Cost Variation" loss of $2202 and a "Manufacturing Expense Variation" loss of $874. These two losses amount to a total of $3076.

* The figures and operations shown in the tables and charts used in this explanation are purely hypothetical and do not represent the business of Stanley Manufacturing Company.

Summary Reports

Turn next to Figure 3, which is a summary of departmental expense reports. Look in the group of columns headed "Label and Nameplates." Near the bottom in these columns on the line "Subtotal Manufacturing," you will find a loss of $2825 and on the following line, "Raw Materials," you will find a loss of $251. These two losses total $3076, the amount you are looking for. Going a little higher, on the line "L.N. Finishing Department," you will find the biggest part of this loss $1985.

Next look at Figure 4 which shows the detail of the label and nameplate finishing department expense report. On the line "Inspect" you will find there is a cost of $1910 over standard.

Your search is ended. You have found the big item causing the decrease in profits. Look at your watch. How long did it take to find it? Longer than 30 seconds, no doubt. But, after you have finished reading this article and are more familiar with the procedure, get out your watch again, and you will surely be able to arrive at the reason for the loss in 30 seconds or less. (The loss of $1910 on the inspection operation in the example sounds unreasonable and a place where an executive would hardly think of looking if his profits began to dwindle. But with scarcity of proper materials and the necessity for maintaining quality, such a case could quite readily occur.)

You have found the cause of your chief loss and have taken steps toward its reduction. But if you have "more than 30 seconds to spare," study the reports in more detail to see what else you can find. Go back to Figure 3 and look again in the label and

GREETING CARDS

BUDGET—1941

Month	SHIPMENTS				PROFIT				PROFIT VARIATION DUE TO				
	Budget	Actual	Variation	Variation To Date	Budget	Actual	Variation	Variation To Date	Shipments	S. and A. Expense	Standard Cost Variation	Mfg. Expense Absorb.	Other
Jan.	150,000	152,316	2,316	2,316	24,167	24,922	755	755	695	*106*	298	*176*	44
Feb.	120,000	125,402	5,402	7,718	15,167	16,945	1,778	2,533	1,621	*17*	*216*	331	59
Mar.	110,000	105,688	*4,312*	3,406	12,167	12,646	479	3,012	*1,294*	842	1,126	*121*	*74*

Figure 1. A quick glance at this report of the greeting card department shows that profits seem to be satisfactory. In this and the following forms, figures in italic are in *red* on the original forms.

LABELS AND NAMEPLATES

BUDGET – 1941

Month	SHIPMENTS				PROFIT				PROFIT VARIATION DUE TO				
	Budget	Actual	Variation	Variation To Date	Budget	Actual	Variation	Variation To Date	Shipments	S. and A. Expense	Standard Cost Variation	Mfg. Expense Variation	Other
Jan.	50,000	52,062	2,062	2,062	–	781	781	781	212	141	312	76	40
Feb.	80,000	78,451	*1,549*	513	6,000	6,677	677	1,458	*310*	223	422	244	98
Mar.	100,000	104,382	4,382	4,895	10,000	7,836	*2,164*	*706*	876	152	*2,202*	*874*	*116*

Figure 2. It takes only a second to see that profits in the label and nameplate department are unsatisfactory

EXPENSE REPORT

Dept. SUMMARY *Date* MARCH, 1941

ITEM	TOTAL		LABELS AND NAMEPLATES				GREETING CARDS			
	Standard	Actual	Standard	Actual	Variation	Variation To Date	Standard	Actual	Variation	Variation To Date
Administrative	5,200	5,228	2,350	2,312	38	106	2,850	2,916	*66*	*312*
Office	6,675	6,611	2,225	2,272	*47*	77	4,450	4,339	111	244
Purchasing Dept.	950	983	475	478	*3*	*51*	475	505	*30*	*101*
L. N. Sales Dept.	13,536	13,382	13,536	13,382	154	475	–	–	–	–
G. C. Sales Dept.	12,859	12,212	–	–	–	–	12,859	12,212	647	997
L. N. Art Dept.	4,000	3,990	4,000	3,990	10	*91*	–	–	–	–
G. C. Art Dept.	9,750	9,498	–	–	–	–	9,750	9,498	262	42
G. C. Editorial Dept.	1,400	1,472	–	–	–	–	1,400	1,472	*72*	*151*
Subtotal Selling & Administrative	54,370	53,376	22,586	22,434	152	516	31,784	30,942	842	719
General Factory	7,000	6,772	3,000	2,950	50	*152*	4,000	3,822	178	*201*
Stores Dept.	2,500	2,345	750	799	*49*	66	1,750	1,546	204	87
L. N. Die Dept.	2,867	3,017	2,867	3,017	*150*	*98*	–	–	–	–
G. C. Die Dept.	3,496	2,971	–	–	–	–	3,496	2,971	525	471
L. N. Press Dept.	11,141	11,832	11,141	11,832	*691*	*201*	–	–	–	–
G. C. Press Dept.	17,101	17,242	–	–	–	–	17,101	17,242	*141*	*249*
L. N. Finishing Dept.	6,685	8,670	6,685	8,670	*1,985*	*1,811*	–	–	–	–
G. C. Finishing Dept.	13,286	13,162	–	–	–	–	13,286	13,162	124	*17*
Subtotal Manufacturing	64,076	66,011	24,443	27,268	*2,825*	*2,196*	39,633	38,743	890	91
Raw Materials	60,793	60,929	42,812	43,063	*251*	*342*	17,981	17,866	115	432
Total Cost and Expense	179,239	180,316	89,841	92,765	*2,924*	*2,022*	89,398	87,551	1,847	1,242
Inventory decrease	–	9,272	–	7,453	–	–	–	1,819	–	–
Transfers between divisions	–	–	–	*3,672*	–	–	–	3,672	–	–
NEW COST AND EXPENSE	–	189,588	–	96,546	–	–	–	93,042	–	–
SHIPMENTS	–	210,070	–	104,382	–	–	–	105,688	–	–
PROFIT	–	20,482	–	7,836	–	–	–	12,646	–	–

Figure 3. A study of this summary expense report makes it possible to see in short order where each gain and loss occurred—the first step in finding ways to continue good practices, correct bad ones

EXPENSE REPORT

Dept. FINISHING *Div.* L. N. *Date* MARCH, 1941

ITEM	Standard	Actual	Variation	Variation To Date
Lay seals	472	513	*41*	22
Spray seals	1301	1280	21	57
Hand paint	305	300	5	*20*
Assemble	613	641	*28*	*77*
Inspect	1867	3777	*1910*	*1876*
Pack	1246	1210	36	*12*
Indirect Labor	381	462	*81*	33
Supervision	500	487	13	62
TOTAL	6685	8670	*1985*	*1811*

Figure 4. Each department head receives a copy of his expense report so that he may go to work on the costs that are out of line.

nameplate group. On the line "L. N. Press Department" you will find a loss of $691. Perhaps this loss is also because of materials. A study of the label and nameplate press department expense report (not shown) will give you the answer. The loss of $251 shown on the line "Raw Materials" may provide you with some further explanation.

Losses Were Offset

So much for the label and nameplate division. Now go back to Figure 1, and have another look at the greeting card division which, on the first cursory examination, was thought to be satisfactory. Although the profits for the month were better than anticipated, a glance at the group of columns headed "Profit Variation Due To" will show that some losses were offset by some greater savings. You will find that, had the shipment volume been up to the budget, there would have been a still greater profit of $1294. Obviously there is something wrong with sales. Turn now to Figure 3. On the line "G.C. Sales Department" you will find a saving of $647. Is it possible that this saving in selling expense is affecting sales volume? A look at the greeting card sales department expense report (not shown) may give you the answer.

Further study of the detailed items in each department's expense report will show some savings and some losses. The savings are fine; keep them. The losses should be studied to find if some means can be devised to overcome them. Thus you will be able to hold on to any savings that may occur and at the same time gradually reduce the losses with one sure result—a steady increase in profits.

Of course, it is axiomatic that each department head receives a copy of his expense report, so that he may intelligently go to work on the costs in his department that are getting out of line.

Now a brief explanation of how the data are obtained and how the profit variations are determined:

The first thing we did was to set up standard costs for operations and classes of expense. This was done with the assistance of the department head concerned. If no records of past performance were available, we estimated the standards. An inaccurate standard, we felt, was better than no standard. Later on, through the data gathered and reported, it was possible to set up more nearly correct standards. Standards were set up for the administrative department in addition to the manufacturing departments.

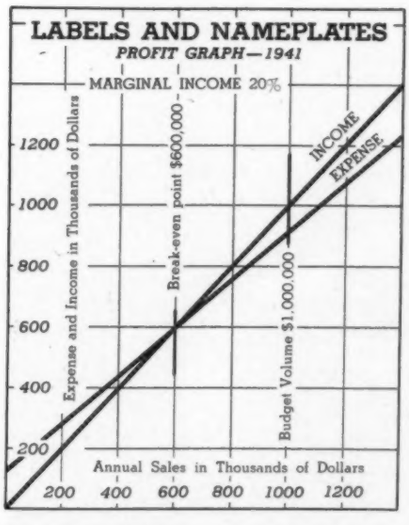


Figure 5. Profit graph for each department is figured from standard costs and budgeted sales

Making a Profit Graph

From these standards it was possible to calculate the administrative and manufacturing costs and expenses for the budgeted volume of sales and to determine the budgeted profit. By separating all expenses into fixed and variable classifications we were able to work up a profit graph, Figure 5, from which the "Marginal Income" was calculated, 20 percent in this case. Refer to Figure 2, where it is seen that the shipments were $4382 above the budget. Multiply this figure by 0.20 and you will get $876, the amount of profit gain due to increased shipments.

In determining the standards for each department we multiply the production for the period by the standard variable costs for the variable items and add the standard fixed costs to get the total standard cost. A comparison to actual costs gives us the variation.

"Manufacturing Expense Absorption" is the difference between actual manufacturing expenses and the amount that is absorbed by the normal burden rates after an allowance has been made for over or under absorption due to the various levels of production.

The column headed "Other" is used merely to take care of any balance. In Figure 2, the total of all the amounts in the group of columns under "Profit Variation Due to" is $2164. If the data used in setting up the budget and calculating the "marginal income" are accurate, the figures in the "Other" column will be almost negligible, unless something unusual occurs and then we attach an explanation. In our first attempt to set up this budget control the figures in the "Other" column were quite large. However, as experience and more accurate data became available, these figures were rapidly reduced.

Now, before putting this article aside, get out your watch again and time yourself in locating the reason for the decreased profit. Pretty close to 30 seconds, was it not?

We Ask "Why?"—and Save

Work simplification develops the questioning habit, uncovers the potential savings in every plant. Here are examples from a program that got under way a few months ago, is now rolling along in high to the big opportunities directly ahead

HAROLD HART KROLL, Industrial Engineer, International Industries, Inc., Ann Arbor, Mich.

THAT NEW LOOK is still on our work simplification program. We have been at it only a few months. Our first four classes, totaling 63 key men and women, still have a few weeks to go before they get their "sheepskins." But our experience is none the less of long enough duration, and the tangible results are already numerous enough, to satisfy us that tremendous opportunities for saving lie ahead—opportunities that all point to the goal of turning out a better product, at lower cost, in less time.

To illustrate what we mean, a half-dozen jobs have been selected from among the several dozen already improved. They will be described here in more or less detail, not because we want to prove how good we are, but merely because they indicate the potential savings that come to light so quickly in any plant when people get the "why?" habit.

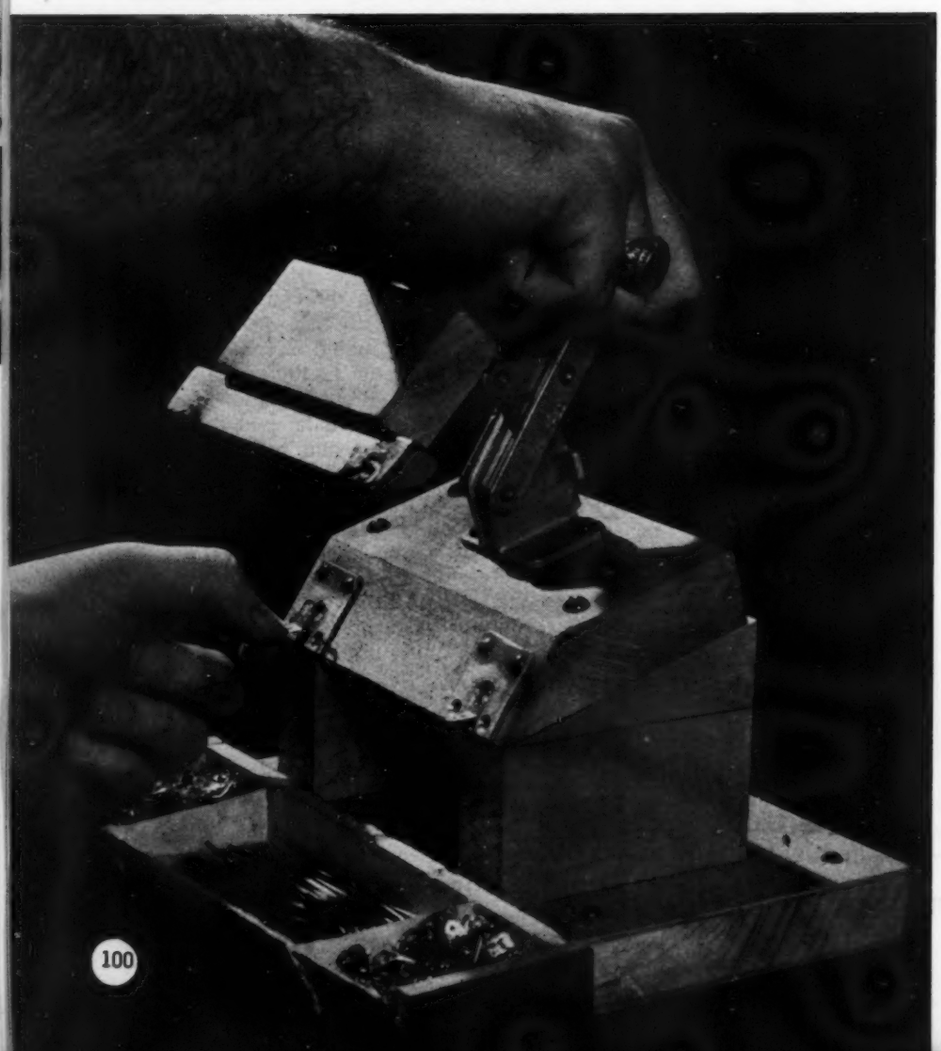
Take, for instance, a simple locking screw with a hole in it. After it is mounted in the chassis of a remote control unit, a staple or cotter pin is twisted through the hole to keep the screw from falling out. The blueprint from the prime contractor showed the hole parallel to the slot in the head of the screw. So the toolmaker built a jig to hold the screw in exact alignment for drilling, and for months the operator set the job up in the drill press with the slot parallel to the drill.

Then someone asked why the hole had to be drilled parallel to the slot. No reason at all, we found. So, because the operator no longer had to align slot and drill, a lot of press time was made available for other war production work.

We did not stop there, however. The questioning continued, and finally the hole was eliminated in favor of a groove around the screw. A snap ring is now used instead of a cotter pin to keep the screw from falling out. We thus saved the cost of drilling.

For a second example, we take you into the inspection department. Here, instead of measuring small taper pins, say, one at a time with a hand-held micrometer caliper, a go-no-go gage is adjusted for upper and lower limits, and a two-handed operation is made possible.

Figure 1. New set-up for joining lugs and connectors involves the use of an inexpensive fixture and a quick-acting clamp. Left hand is shown positioning the lug. Right is demonstrating the clamp action. In actual practice the two lugs are positioned simultaneously



One-Third the Time

Elementary? Of course. So are the gage-side boxes which take oversize, undersize, and right-size parts. But note that inspection by the new method is accomplished in less than one-third of the old time, and remember that many, if not most, of the better ways of doing things are "elementary."

Figure 1 shows a new set-up for joining lugs and connectors. In the old method, the lugs were slipped over screws and secured with nuts to prevent their twisting out of position. Nuts had to be tightened with a socket wrench.

Now the job is done with the aid of an inexpensive fixture and a quick-acting clamp. The clamp has a rapid opening action for little hand movement, and in the closed position it exerts firm pressure. In the photo-

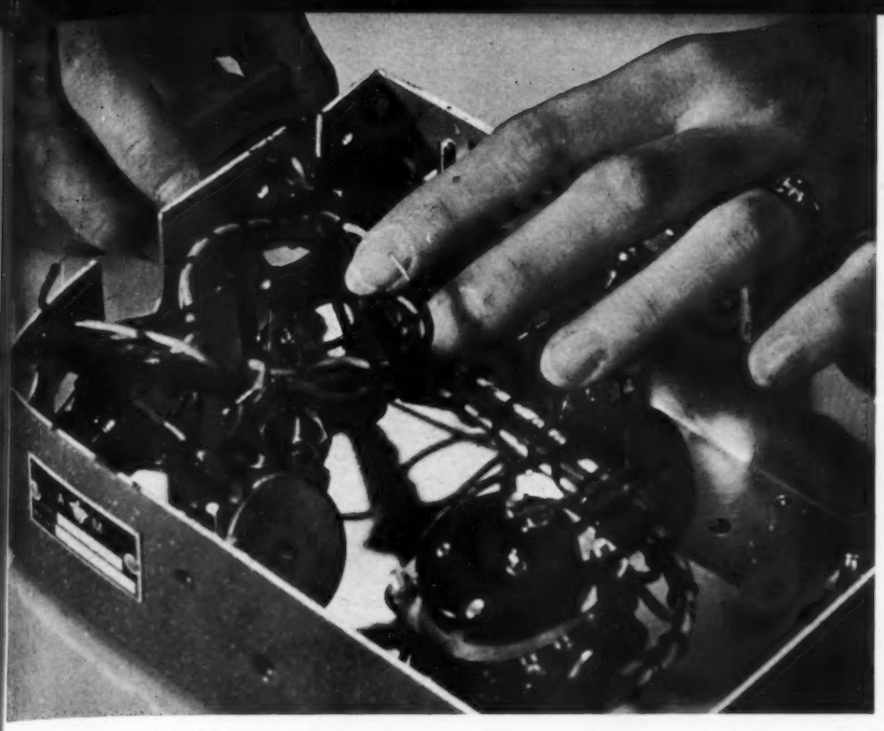


Figure 2. A design change saves 25 percent of assembly time. Slot cut in case at mounting hole makes it possible to pre-assemble and solder switches to cable before placing in case. Formerly, because the switches were too big for the hole, the cable was bunched up and squeezed somehow into the case. Then, in the cramped interior, the cable was straightened and the electrical connections were completed

graph the left hand is shown positioning a lug in the recess that holds it for clamping, while the right hand is demonstrating the clamp action. In actual practice the two lugs are positioned simultaneously. Note the built-in easy-grasp receptacles for lugs and connectors. Direct labor saving on this job was about 20 percent, the apparently small figure being due to the long do element.

Figure 2 illustrates a design change affecting our method of assembly. The slot cut into the case at the mounting hole (close to the operator's right hand) enables us to pre-assemble and solder all the switches to the laced cable before placing in the case.

Previously, because none of the switches would fit through the hole, the cable was bunched up and after some manipulation was squeezed into the case. Then, in the cramped interior of the case, the cable was straightened and the electrical connections were completed. The switches were then joined to the chassis in working position. Repairs and replacements also were difficult.

With the slot in the case, the switches are joined to the cable in jigs that make wire connection and soldering easy. No straightening is needed after the cable is dropped into the case. Just the joining is required to put the switches in working order. Savings in assembly time are estimated at 25 percent.

Grouped in Figure 3 are three photographs that show how two drilling operations have been combined. The old method is depicted in the left and center pictures, the new in the photograph at the right.

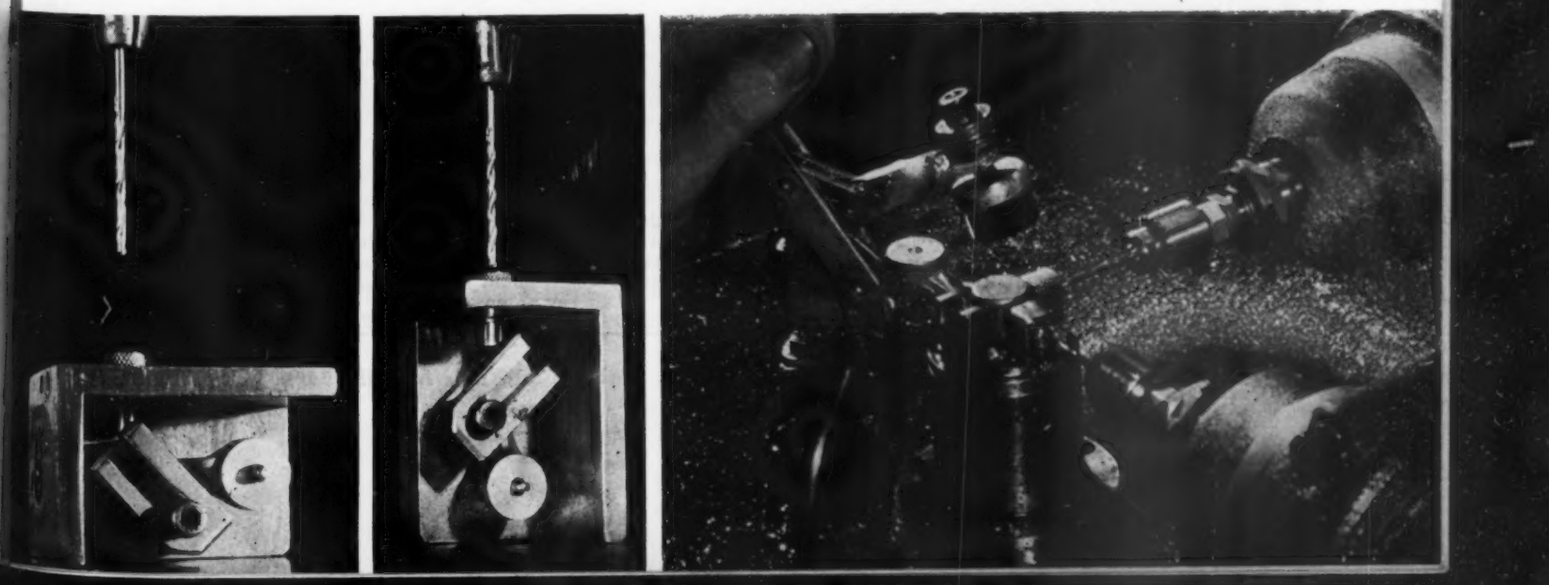
It is necessary to drill two holes at right angles in the side of a pointer knob. Formerly a drill jig weighing several pounds had to be handled twice after the knob was secured to it. The drill press was hand-fed. The two pictures of the old method show how the drill-jig bushing had to be positioned twice, also how the jig had to be re-positioned after the first hole was drilled.

How They Do It Now

In the improved method the drills are chucked to two high-speed portable grinders equipped with automatic feeding mechanism. When the operator, who now sits at the job, steps on the switch, the motors start up and the drills are driven forward by centrifugal force. When penetration has been completed, the operator steps on the switch and the drills are withdrawn. A quick-acting clamp is used to hold the knob in position, and makes possible a short *make-ready* and a still shorter *put-away*. The operator handles knobs weighing a few ounces instead of a jig weighing pounds. Foot-operated air jet blows away the chips. Savings in direct labor amounted to a little more than 70 percent.

Those are samples. They illustrate the possibilities. We are taking 16-mm. films of many of our improvements, and are showing them to people in every department during rest periods. This, like our classes for key people, is all part of the over-all plot to instill the habit of questioning into the consciousness of every man and woman in the plant. When they begin to ask *why*, the savings roll in.

Figure 3. Two drilling operations became one. Old method (left and center) meant positioning drill jig bushing twice and re-positioning jig after first hole was drilled. In new method (right) drills are chucked to portable grinders equipped with automatic feed. Labor savings run around 70 percent



How Healthful Is Your Plant?

Benefits from a check-up of working conditions will include (1) conservation of manpower, (2) fewer absences, hence greater production, (3) protection against unjust claims, (4) improved employee relations and better worker morale

JOHN F. McMAHON, Managing Director, Industrial Hygiene Foundation, Pittsburgh

As AMERICAN INDUSTRY surges into the lead in the world production race, plant managers are alert to the grave problems of plant maintenance. But what about *the maintenance of men?* Increasing production, zooming to new peaks, tends to increase hazards to the health of workers, endangering the army in overalls which is forging the weapons of war. Health precautions, therefore, *must* keep pace with production. Otherwise maximum output is impossible.

One practical and necessary precaution today in cutting the waste of manpower is the industrial hygiene survey. A survey is to a plant what a physical examination is to an employee. It is a kind of industrial health inventory, a check-up on health conditions. Surveys show up the presence or absence of positive or potential hazards. If dangerous conditions are found, practical measures can be taken to eliminate or control them.

Hazards Are Increasing

The speed-up of modern production, the large-scale use of chemicals in manufacturing, the rise of synthetic products and substitutes, the creation of new materials and processes, have all served to multiply health problems in industry. Whizzing power drills replace the pick and shovel, spray guns supplant the paint brush, electric welding is constantly increasing, metal pickling and plating operations are accelerated, chemical solvents, compounds, and derivatives become bywords in factories. Dramatic progress, yes, but also a corresponding increase of dangerous dust in factory air, poison fumes, and vapors, and gases, arising from metals and chemicals, oils and synthetic materials that irritate the skin—a host of potential hazards. But virtually all industrial health risks can be overcome, hence the industrial hygiene survey (1) to locate occupational health hazards, if any exist, (2) to recommend proper control measures.

The table lists some of the toxic dusts, vapors, and gases encountered in industry, together with what are generally accepted as "safe limits." But, because of incomplete data, and because of the variability in humans and in working conditions, it is impossible to be too specific. For instance, these "limits" are intended for normal workers under normal conditions. Some of the figures should probably be lower where men are working longer hours and thus have longer exposures, or where women or older men are involved. These limits are given because plant management must have something definite "to go on," but it must be re-emphasized that at best they are merely signposts in the direction of safe practice.

The first step in a survey is an over-all appraisal to locate any processes, materials, products, or conditions, including sanitary facilities, that may affect health.

Second, where possible hazards are noted, tests are made to determine scientifically whether the exposure is sufficient to be dangerous. These tests usually involve air sampling and laboratory analyses.

The third step is the devising or recommending of practical measures to control any hazards detected. These

(*Continued on page 208*)

Safety Limits for Toxic Substances

METAL DUSTS AND FUMES
(milligrams per cubic meter of air)

Cadmium	0.1	Mercury	0.1
Lead	0.15	Zinc	15.
Manganese	30.		

CHEMICAL VAPORS
(parts per million parts of air)

Amyl acetate	400	Formaldehyde	20
Aniline	5	Methanol	200
Benzol	75	Monochlorbenzene	75
Butyl acetate	400	Naphtha, gasoline	1000
Carbon disulfide	15	Nitrobenzene	5
Carbon tetrachloride	100	Tetrachlorethane	10
Dichlorbenzene	75	Tetrachlorethylene	200
Dichlorethyl ether	15	Toluene and Xylene	200
Ether	400	Trichlorethylene	200
Ethylene dichloride	100	Turpentine	200

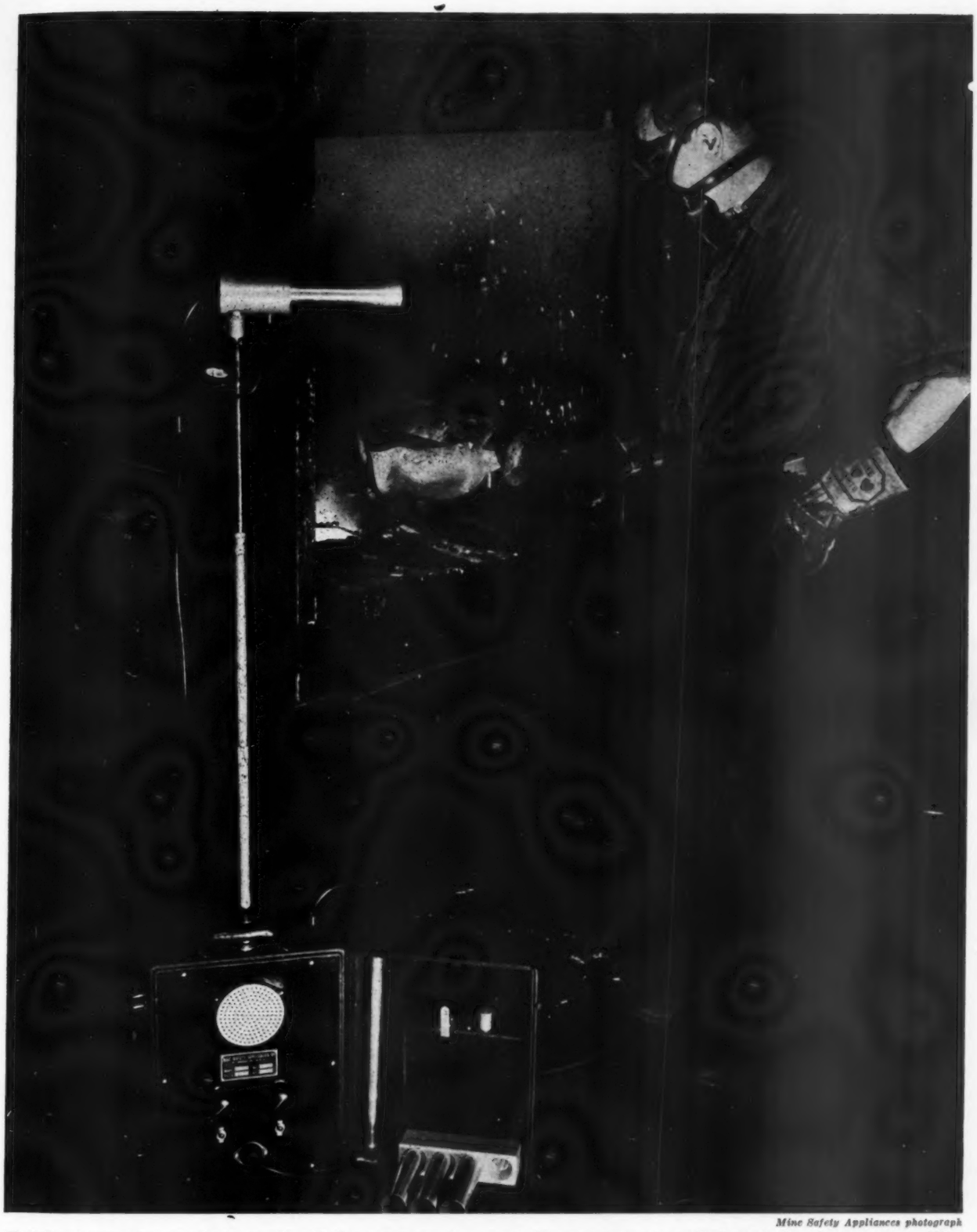
GASES
(parts per million parts of air)

Ammonia	100	Hydrogen sulfide	20
Arsine	1	Oxides of nitrogen	40
Carbon monoxide	100	Ozone	1
Chlorine	1	Phosgene	1
Hydrogen chloride	10	Phosphine	2
Hydrogen cyanide	20	Sulphur dioxide	10
Hydrogen fluoride	3		

(In some states, limits such as these are now incorporated in codes administered by state health or labor departments)

Some authorities hold that a safe limit for dusts low in free silica is 100 million particles per cubic foot of air; others advocate 50 million. For dusts high in free silica, some advocate 10 million particles and others 5 million. In the absence of more definite data plant management should play safe, keeping all dusts down to the minimum

A Survey Will Tell



Mine Safety Appliances photograph

Quickest way for workers to absorb the common industrial poisons is to breathe them. Where hazards are known to exist, tests will determine whether or not the exposure is sufficient to be dangerous. The tests usually involve air sampling — as here, with an electrostatic dust and fume sampler.

I'd Like the Night Shift, If—

The author is employed by a well-known company which is by no means a laggard in the fields of public and human relations. It would seem, therefore, that many plants can learn from her experiences and profit by her suggestions

ESTELLE BUSKY, Wage Earner in a War Products Plant

"Nine o'clock in the morning found me in bed and fast asleep. But not for long"

I WENT TO WORK on the night shift of a large war plant because my business was killed by the war. I started on a war production job with enthusiasm. The business I left had been exciting and highly paid, but it didn't belong to a war period. I was in utter agreement with the restriction of luxury business for the duration.

With this new job I could take my place in the war effort. I accepted the night shift because the novelty of the hours appealed to me. In addition I was offered a 10 percent bonus for working at night. My shift began at midnight and ended at eight in the morning, six days a week.

My first job required manual skill. In my own work a variety of manual skills were essential, so my adjustment to the new work was easy. I didn't get much sleep the first week, but that didn't bother me on the job. I had a good reserve to draw on and my interest in the new routine made the nights pass quickly. I was soon able to produce more than the required number of operations, and then I had time to take a look at the girls around me. They looked tired and sleepy.

They were good-looking, attractive girls between 21 and 30. They were housewives and mothers and girls whose sweethearts had gone to war. Some, like myself, came from industries that had been cut by the war. They were friendly, and I liked them. In a good-natured way they razzed my passionate approach to the job. For themselves they seemed to accept their physical depression as a necessary part of night work. Their attitude toward me was, "You feel all right now. So did we in the beginning. But wait awhile, the night shift will get you."

Tired All the Time

And get me it did. After two weeks I was tired all the time. I took a bus the few blocks home, too tired to care about the morning or food, or anything but sleep. Nine o'clock in the morning found me in bed and fast asleep. But not for long. My telephone, once a useful fixture in my life, became an instrument of torture. My family and friends and former business associates called me for anything or nothing at any time during the day. These people casually woke me up, although any one of them would have thought me stark raving mad had I called them at five in the morning, just to say hello and how's the new job coming. But calls came tearing through my sleep at the equivalent of five in the morning for me, almost every day. On rare days, when my sleep was unbroken, I would perform such whirlwind feats of activity between four, when I got up, and midnight, that instead of being ready for my eight-hour stint of night work I was ready for bed again.

I don't know how much sleep the other girls were getting, but most of the time we were all painfully sleepy and tired. It was an awful pull to our half-hour lunch period at three-thirty in the morning. I had no desire for food at that hour. For me it was a rest period with a glass of milk or a piece of fruit. My appetite practically disappeared and I ate because I knew I should. After lunch we hit a real low. Around 5.30 a. m. our eyes refused to stay open and we had to go to the restroom again and again to splash cold water on our faces.

Most of the girls had been on the job a short time. New girls were arriving practically every night. Invariably they asked us, "What do you do to keep awake?" They hoped for a magic formula, but we had little to offer. We pooled our ideas for pick-ups. There was the ladies' room. There were nickel vending machines. And that was about all. There was medical in an emergency. But we couldn't go to medical and say we were tired.

Unable to Take It

I began to feel terribly discouraged about working at night. The girls were dying to be transferred to the day shift. There were a few who, because of special conditions at home, couldn't have worked on the day shift. While these girls valued the opportunity to work at night, they weren't any better able to take it. The general tiredness that hung over the department was in itself a depressing factor. People dozed sitting upright. Sometimes in a split second of dozing an accident occurred.

What was the matter? Eight hours a day was less than I'd worked in many years. The work was not too hard. The people were pleasant to work with. The supervisors were considerate. What was it, then? Was it just the night air? I couldn't believe that. Eight hours of work was just eight hours of work, no matter what time of day it was done. Thinking about it, I realized that I had made no plan for adjusting myself to new working hours.

I had been getting up and using the best of my energies for recreation and then going to work exhausted. I had to make a plan that would allow for my arriving at work rested from sleep, just as a day worker does, and plan to use the morning as my "evening." I decided that I would sleep from two in the afternoon until ten at night and that after the job I would stay up until my bedtime.

My telephone would have interfered with my plans. My family and friends, without meaning to, were breaking my sleep almost daily. I simply had my telephone removed. I had made up my mind that come hell or high water my job was my first consideration.

My plan worked and I found my life assuming normal proportions, if at unaccustomed hours. My appetite returned. My job was fun again and I discovered that my recreation was as relaxing and pleasant in the morning as it had ever been in the evening. I slept well and had ample energy.

"After lunch we hit a new low. Around 5.30 a.m. our eyes refused to stay open"

My basic schedule is necessary to anyone on a night shift. To do a good job you must go to work refreshed from sleep, and that means you must have your recreation and social life in the morning. Most workers don't like this schedule because they can't find amusement and recreation during the morning hours. The real difficulty is lack of companionship, but there are so many night workers now that simply by getting them together into groups for sports or social activities many more things could be made available for fun in the morning.

"Give her a good pin"

Family Must Cooperate

The night worker can make an adjustment with her day-working family. If the family understands the special problems of night work, and is told directly how to cooperate with the night worker's schedule, even when it means extra meals and some inconvenience, they will have the satisfaction of helping the war effort by helping their night worker remain fit and happy.

Why are we working on the night shift? Because we are at war. As war workers we must live well in order to produce as much as we can. Just as management has offered a special rate of pay for working at night, it must come to see that night work has special problems for the individual. The problem of good production from a night shift is one of management. The night worker must be stimulated

(*Continued on page 212*)

Thousands of Employee Ideas

Suggestion plan, says Pullman, means extra cash in pockets, hence better worker morale. Ideas come in at the rate of 500 a week. In 16 months 1700 people got $42,000 for 3700 ideas in awards varying from $5 to $750

E. S. TAYLOR, Director, Employee Suggestion System, The Pullman Company, Chicago

OUR SUGGESTION SYSTEM, encompassing approximately 25,000 employees, has produced notable results. In the first sixteen months of its operation a total of 34,000 suggestions (an average of about 500 per week) for improvements to Pullman equipment, operations, and practices were submitted by employees, and of this number 3700 ideas, submitted by 1700 individual employees, were adopted. Awards amounted to $42,000 with individual amounts ranging from a minimum of $5 to a top of $750.

Any suggestion system is a success if it gets results. It is a failure if it does not have the full support of employees and management. Without that support usable suggestions will not be submitted. It is not enough to establish the machinery for a suggestion system. Nothing will be gained if the familiar suggestion box is nailed up on the shop wall without a full-time and well-planned program behind it. Such a move, in fact, not only would be a wasteful expense but also would prove to be a powerful discouragement to employee morale.

Operating experience with the employees' suggestion system, as it is now functioning throughout The Pullman Company, has led us to believe that a suggestion plan must be conducted (1) anonymously, (2) impersonally, (3) impartially, (4) conscientiously, (5) honestly, (6) tolerantly, (7) patiently, (8) liberally, (9) accurately, (10) effectively.

The failure of many plans is attributable to the fact that they are not conducted on an anonymous or impersonal basis; in fact, many of them are, in a sense, one-man activities. This in itself destroys opportunity for full cooperation on the part of the supervisory forces, which is essential to the successful and effective conduct of the suggestion plan. When the system requires that employees sign their suggestions, giving their home address, so that management is immediately aware of who the suggester is and in a sense circumvents his supervisor by corresponding with the employee directly at his home, the opportunity for full cooperation on the part of the supervisory forces is destroyed.

A good plan offers a definite educational program to employees since it fosters systematic and constructive thinking. It provides an opportunity for employees to express this thinking in tangible form. It instills confidence in management. It develops men and helps in many instances to bring them to management attention.

Must Know the Company

It is important that the director of the suggestion system be an individual who has had broad experience in all phases of the company's activity. He may be an ardent supporter of the rules and regulations governing the plan, but his work may well be in vain if he lacks the necessary experience and does not have a full knowledge of the company's business, its organization, and its personnel. The director will be powerless, however, no matter how experienced he may be, unless he can command the unstinted support and cooperation of the executive heads.

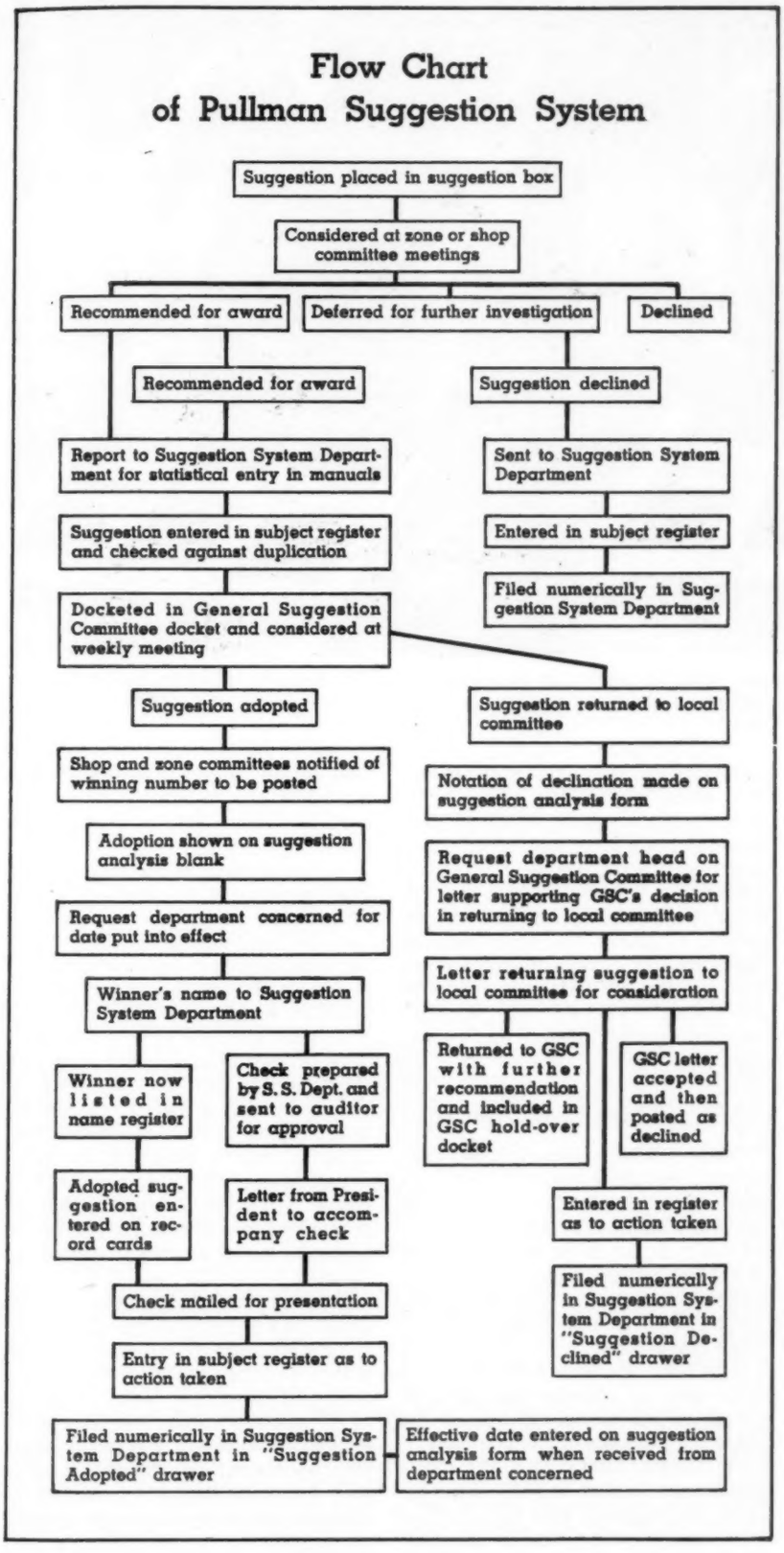
Suggestion boxes must be set up in suitable locations where they will be available to all workers. The Pullman plan includes one box for every 50 employees. The standard box is 27 inches high and 12½ inches wide with provision at the top for a graphic poster known as a "weekly thought stimulator." The box below with slot —on the order of a mailbox—is locked to prevent tampering, and below it is a rack for holding suggestion blanks.

An important feature of the successful system is the personnel of committees. Each shop, division, or other unit has a committee composed of representatives from that particular unit. These committees are kept small —10 or 12 people are ample; a smaller number is desirable. Members of the committees consider each suggestion has merit until it is proved to the contrary. The secretary of the committee is made responsible for collection of suggestions at least once a week.

Prior to the weekly committee meet-

Long acquaintance with almost every phase of company operation qualified E. S. Taylor for the post to which he was appointed in March, 1941. He began at Pullman 40 years ago as auditor's clerk, climbed via two chief clerkships to be, in 1920, assistant to the president, also secretary of the committee on standards. Then director of purchases and assistant manager of stores. Later became assistant to Vice-President Champ Carry of the operating department. Mr. Taylor is now president of National Association of Suggestion Systems

Increase Operating Efficiency


Flow Chart
of Pullman Suggestion System
Suggestion placed in suggestion box
Considered at zone or shop committee meetings
Recommended for award
Deferred for further investigation
Declined
Recommended for award
Suggestion declined
Report to Suggestion System Department for statistical entry in manuals
Sent to Suggestion System Department
Suggestion entered in subject register and checked against duplication
Entered in subject register
Filed numerically in Suggestion System Department
Docketed in General Suggestion Committee docket and considered at weekly meeting
Suggestion adopted
Suggestion returned to local committee
Shop and zone committees notified of winning number to be posted
Notation of declination made on suggestion analysis form
Adoption shown on suggestion analysis blank
Request department head on General Suggestion Committee for letter supporting GSC's decision in returning to local committee
Request department concerned for date put into effect
Letter returning suggestion to local committee for consideration
Winner's name to Suggestion System Department
Returned to GSC with further recommendation and included in GSC hold-over docket
GSC letter accepted and then posted as declined
Winner now listed in name register
Check prepared by S. S. Dept. and sent to auditor for approval
Adopted suggestion entered on record cards
Letter from President to accompany check
Entered in register as to action taken
Filed numerically in Suggestion System Department in "Suggestion Declined" drawer
Check mailed for presentation
Entry in subject register as to action taken
Filed numerically in Suggestion System Department in "Suggestion Adopted" drawer
Effective date entered on suggestion analysis form when received from department concerned

ing, the secretary writes the suggestions up in the form of a docket, giving a copy to each committee member for his consideration and preliminary investigation. When the meeting is called, the docket is considered by the entire group which either declines the suggestion or recommends that it be adopted and an award granted. Recommendations of the local committees are all forwarded to the office of the director of the suggestion system where they are again made up in a combined docket for consideration by the General Suggestion Committee. This latter group is comprised of the heads of the various departments and also holds regular meetings once a week to consider recommendations of the local committees.

Establish a Minimum

Awards paid suggesters should be as liberal as possible with a stated minimum no matter what the value of an accepted suggestion. A minimum award of $5 has been established in the Pullman plan with no maximum, payments being based on 10 percent of the first year's gross savings resulting from the accepted suggestion. The general committee, in making the award, estimates the savings that will accrue to the company by adoption, and 10 percent of this amount is paid the suggester.

At the end of the year an exact record of the saving is compiled; if the original estimate has been too small, the difference is paid immediately. It is more or less essential that awards be based on gross savings; obviously, if net savings were to be the basis, it would be necessary to do considerable bookkeeping to ascertain the net results after considering expense of adopting the suggestion—i.e., cost of materials and labor, plus depreciation, departmental expenses, overhead, etc., which in itself would involve considerable work and expense.

Because the time interval between the actual writing of a suggestion and its acceptance or rejection might frequently stretch to longer than a month, and because the suggester often becomes anxious as to the outcome almost immediately following the moment he drops his idea in a box, the Pullman plan includes an added provision to maintain the suggester's interest and at the same time keep him advised as to his suggestion's

"Ouch!" That's what Pullman emloyees used to say as they skinned their knuckles against the wall

No skinned knuckles since a worker devised truck guards and won a suggestion award for the idea

progress. Accordingly, a weekly bulletin is posted on all bulletin boards on which is shown the number of the suggestion corresponding to the identification coupon the employee retains. Numbers are posted when the suggestion is first picked up, and the progress of the suggestion through the system is traceable until final acceptance or rejection. At any given moment the employee can look at the bulletin and tell at a glance the status of his suggestion and whether it is under consideration at headquarters.

Routine duties of the suggestion department include acting as the ultimate depository for all suggestions. These are first classified and registered or indexed and cross-indexed under hundreds of different subjects by clerks having some knowledge of the subjects. Weekly dockets are compiled showing recommended disposition of the suggestions for information and consideration of committee members prior to their meetings. All local committees are advised of the action of the general committee on each suggestion: award checks are issued and individual letters written transmitting these checks.

The suggestion department records all awards by individual names and maintains complete statistical records. This office also feels that one of its most important duties is to see that accepted suggestions are actually put into effect as quickly as possible because it has been found that great interest is indicated on the part of employees to know that their adopted suggestions are actually made effective. The weekly posters, or "thought stimulators," are selected by this office and mailed all over the country once each week.

More Than One Award

Many employees have been repeaters. A machinist in the iron department of the St. Louis shop leads the list with 23 accepted suggestions for which he has so far received a total of $255 in awards. A clerk in the Calumet shop has received $135 for 13 suggestions, and an upholsterer $240 for seven suggestions.

The ideas accepted have covered a wide range of activities and have resulted in substantial savings in the operating expenses of the company.

An electric repairman in the Dover Street yard, Boston, is $325 richer because he suggested that the electrical repair record cards carried in each Pullman car be changed four times a year instead of every month. Time saved is estimated to amount to about $3250 yearly.

An upholsterer at the Chicago and Northwestern yards evolved an ingenious tool to be used in the stretching and adjusting of webbing in its application to sofa and seat backs. It is estimated that this suggestion, for which he was awarded $100, will result in a yearly saving of at least $1000.

A supervisor in the watch department received $225 for the suggestion that the use of a special machine for requisitioning material would save time and expense. A leader in the paint department of the Calumet shops received $215 for suggesting that all trimmings on refinished troop cars be painted in solid colors instead of bronze.

Another electric repairman in a different part of the country—the Southern Pacific yards at Los Angeles—suggested a change in the application of air-conditioning drive belts, at a saving of 50 cents per belt, and as a result won an award of $125. A price clerk in the purchasing department received $75 for suggesting the salvaging of armature shafts by the use of a metallizing process.

Significant Labor Developments

Period surveyed: August 10 to September 10

TREND INDICATORS

Proximity to Production Required by Wage-Hour Act

Since an employee to come within the benefit of the Wage and Hour Act must be sufficiently close to production for interstate commerce, the Wage and Hour Administrator ruled: If a foundry casts unfinished parts that are later finished by a manufacturer within the state and installed in a plant intended for interstate production of goods, the employees of the foundry are too far removed from the production of goods for commerce to come within the Act. This same rule will apply even if the foundry finishes the parts before selling them for installation. On the other hand, when the parts wear out and are returned for repair or replacement, such work of repair is deemed sufficiently close to the production of goods for commerce to make the Act applicable.

Reduction in Overtime Illegal

A reduction of pay in such manner that when overtime was added to the regular wage the total would not exceed the wage paid before the reduction was held to be in violation of the Wage and Hour Law.

While the Supreme Court ruled differently in the Belo Case, the reduction in that case was made pursuant to contract; in this case there was no contract. (Anuchick vs. Trans-American Freight Lines, Inc.)

Wagner Act Protects Litigants

Employees are entitled to the protection of the Wagner Act even when they file information or bring a wage suit under the Wage and Hour Act. (Spandsco Oil & Royalty Company.)

Penalty for Wage-Hour Violation

Federal District Court of Brooklyn affirmed the Court's power to hold in criminal contempt one who violated an injunction issued under the Wage and Hour Act against the Bushwick Clothing Company, which pleaded guilty to charges of forcing its employees to "kick back" part of the amounts paid them as restitution of back wages.

WAR LABOR BOARD

** WLB Announces Grievance Procedure*

Further inroads on management's ancient prerogatives were made by the procedure promulgated by WLB for handling grievances.

Aggrieved employees are awarded the option of being accompanied by shop stewards (union officials) in the presentation of their complaint to foremen. Time for considering the grievances is reduced to two days at the first stage, three at the second and third stages, and five days at the fourth. (Norma Hoffmann Bearings Corporation.)

** WLB Orders Equality in Pay*

WLB took a radical step when it ordered equality in pay to women who take the places of men and fully perform all of the tasks heretofore performed by men. Where male assistance is required, as in the handling of heavy machines, a recognized differential based upon proper time studies is to be established. However, despite the announcement of this principle WLB sanctioned a 10c. lower differential in starting rates between men and women. (Norma Hoffmann Bearings Corporation.)

** WLB Grants Retroactive Wage Increase*

While contracts are to be respected, WLB has gone on record as willing to alter contractual terms where these terms interfere with its stabilization program.

Accordingly, in following the Little Steel formula, it ordered the "Big Steel" companies to include in their contracts with the steelworkers' union clauses providing for maintenance-of-membership, check-off of union dues, and a retroactive wage increase—as of the date when the union issued a press statement that it would seek the same terms from Big Steel.

This retroactive increase it granted despite the companies' claim that, under the terms of the collective bargaining contracts with the union, old wage rates were to remain in effect until 10 days after either party had filed written notice. (Carnegie Illinois Steel Corporation.)

** WLB Directs Shifts*

WLB ordered management of a small plant to substitute rotating shifts by steady shifts since no serious difficulties would be entailed in the change, and management had not established that the change was impracticable or would retard production. (Towne Robinson Nut Company.)

Former Employees to Be Used on War Work

A plant converting from civilian jobs to war work must rehire its old employees according to seniority before engaging new workers for jobs that require comparable skill. It must also pay wages equivalent to those formerly received. For failure to make such equivalent payments the Board ordered the difference paid retroactively. (Underwood Elliott Fisher Company.)

** WLB Warns on Pledge Violation*

Resort to strikes will be cause for refusing unions the protection of union maintenance. The offending union was, however, assured that the employer would not be permitted to take advantage of the Board's denial of the security clause. (Monsanto Chemical Company.)

** No Increase Though Pay Substandard*

The flexibility of WLB's standards is manifested in the exception it made when it refused to order a raise in substandard wages. In the particular case, the employer was not only financially unable to meet such an increase, but the wage level paid was not below that which prevailed in the industry generally. Management was required, however, to pay an increase which it insisted was the maximum it could afford in the circumstances. (Cambridge Tile Manufacturing Company.)

No increase was allowed where ex-

(Continued on page 216)

* In this and the following classification items marked with an asterisk also are considered to be trend indicators.

On the first day of unexplained absence a telegram goes to the employee's home: "War production workers should be on their jobs. Explain absence." It's the first step in a plan that cuts absenteeism

Breaking the AWOL Habit

"Absence without leave" was costing thousands of man-hours—and woman-hours, too—till a program calculated to shock offenders out of the habit cut all absenteeism, excused or unexcused, to 2 per cent, with a chance of batting it lower

W. I. NEWMAN, Personnel Director, Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

UNNECESSARY ABSENCES were cutting too large a slice off our war production shipments. Demands by the War Department for greatly increased production and howls from our production department because of idle machines and lost man-hours, made it imperative that this leak be promptly and effectively plugged.

How to do it was a problem. If a worker doesn't want to work on Monday, or the day after payday, and if he can get a dozen other jobs up the road a ways, how the Sam Hill can we *make* him work? We hammered away with posters appealing to patriotism and pointing out the seriousness of lost productive time. They helped, but they weren't personal enough. The worker just accepted them as being meant for the other fellow. So our problem was somehow or other to get to him—or to her—in person.

Gates Are Closed

First we made it awkward and inconvenient for the late-comer, and then we made it really tough for the absentee.

Lates, formerly allowed to enter the plant whenever they got there, find the gates closed to them. They are directed by a couple of unsympathetic guards to try their luck at the personnel office. There they cool their heels along with a roomful of other "lates," "lost badges," etc., until their turn comes. If they can explain to the personnel man, who himself has rolled out of bed at 5:30 a.m. and isn't in a particularly sympathetic mood either, they are passed in. Repeaters that week get a day off without pay. A double repeat means that we probably made a mistake when we hired him, and he is replaced.

Absentees are handled no more gingerly than lates. On the first day of unexplained and unauthorized absence a telegram is sent to the work-

er's home reading: "War production workers should be on their jobs. Explain reason for absence."

No one likes to get telegrams. Usually they mean bad news, hence they are more effective than telephone calls or personal visits. The whole family sits up and takes notice when a telegram arrives.

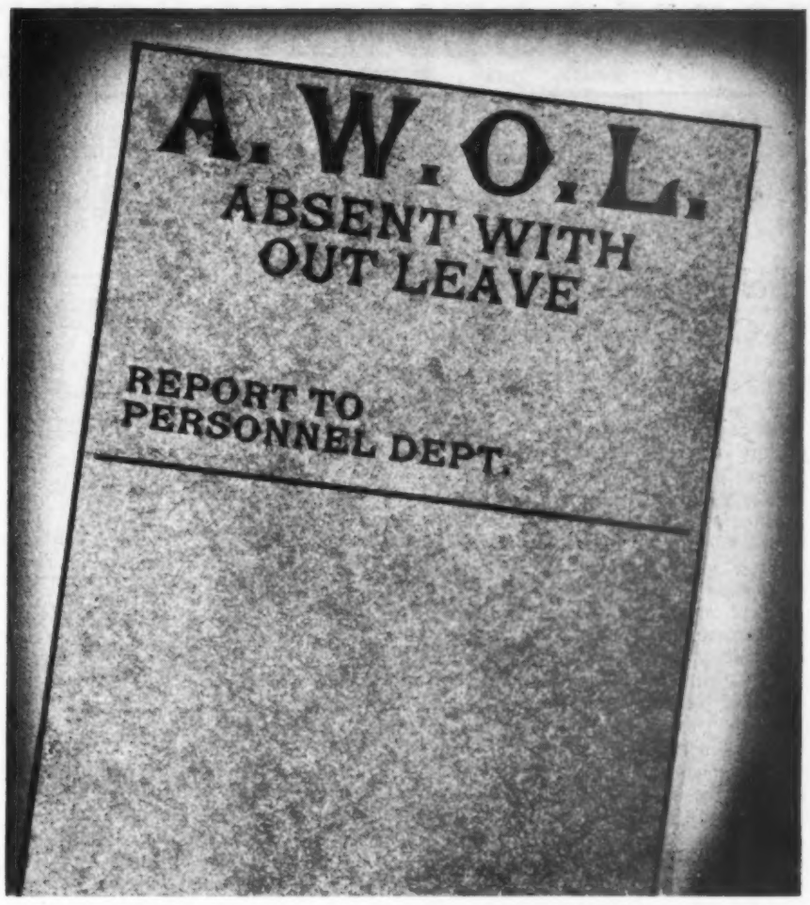
On the second day of unexplained absence the absentee's employment is suspended. His time card is removed from the rack, sent to the personnel director, and replaced by a scarlet-fever-colored card reading "AWOL—*Report to the Personnel Department.*" He is not permitted to start work until he has satisfied the personnel director that his reasons for absence and failure to notify were good ones. In the meanwhile he is spotted, for all to see, by the shirker's card in the time rack. Most workers don't like to have that happen more than once.

Foremen Cooperate

The foreman's cooperation and support are obtained in two ways. First, and naturally, he realizes that an unusual number of AWOL cards in his department's time-card racks don't speak too well for the efficiency of his division, so he does his best to hold them to a minimum. Second, the first question he is asked on the regular Monday departmental inspections that are made by the works manager and the production manager is: "How does your attendance sheet look?" Obviously the foreman will support anything that tends to make it look better.

Does our plan work? Well, tardiness is down to 2 percent, less than half of what it formerly was, and to a point below which, under present emergency conditions, we believe it will be difficult to go. Absentees, whether excused or unexcused, are close to 2 percent, with possibilities of batting the figure still lower. Thousands of man-hours have been salvaged that formerly were unnecessarily lost. Precious production hours previously frittered away at the beaches are now spent at the benches.

How do the workers take it? Just fine. Just as the American production soldier will accept any condition, meet any situation, once he is made to realize the disastrous consequences that may follow his failure to do so. Those who were at first a little resentful and rebellious proved amenable to reason after a little persuasion. To the three or four who didn't we said, without much regret, "Goodbye and good luck. Hope you do better elsewhere."



On the second day away from the shop, the AWOL worker's time card is removed from the clock rack and this shocking one substituted. Its scarlet-fever color spots him, for all to see, as a shirker

Late comers get short shrift. Gate is closed. Unsympathetic guards suggest that the girls try their luck at the personnel office

MANAGEMENT SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for

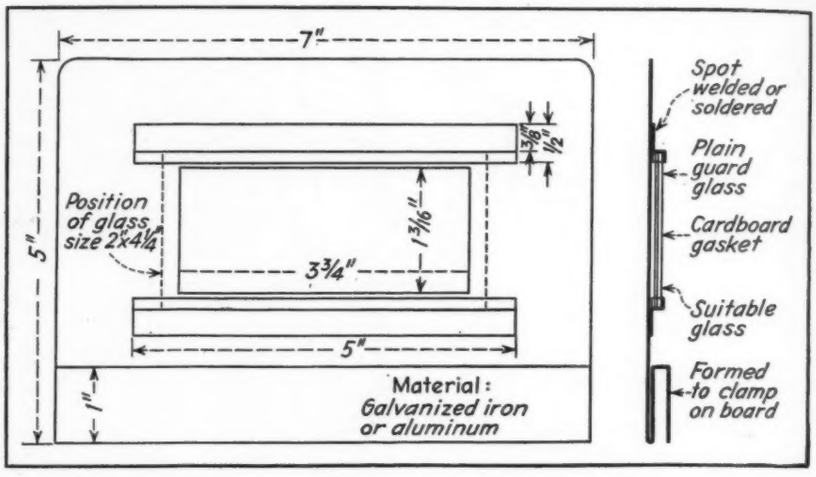
Each Machine Tool Has Its Own Tool Cabinet

FRANK ROTH, New York

Tools and attachments for each machine tool are kept in a combination cabinet and rack set up right beside that tool in this plant. Not only are steps saved for the operator when the need for a tool arises, but he knows also that he is sure to find the tool in that cabinet, and not some other place in the shop.

These cabinets have been found to be a convenience, time-savers, tool-protectors, and a means to a neat shop. Each machine has its own cabinet and in each cabinet each tool has its assigned place.

In the picture, to the left and behind the machine, can be seen another expedient—the white enameled steel sheet fastened to the wall and extending up over the window sill. This sheet catches oil and coolant thrown by the machine. It was not convenient to place a guard or shield on the machine at this point, so that the enameled sheet is used to catch the spray and keep it off the window and wall. When he cleans up, all the operator must do is walk behind the machine and wipe a clean cloth across the shield.



Shield on Time Study Board Protects Eyes

JAMES M. APPLE, Flint, Mich.

In taking a time study of an arc welding operation it is necessary for the observer watching the operator or his work to provide protection for his eyes against the injurious rays of the flame. Because a regular arc welder's helmet is restrictive to the vision, I devised a guard to clip on the edge of the time study board.

This guard consists of a piece of galvanized iron or aluminum cut to suit the measurements of the board for which it is intended. In the center is a rectangular hole in which are inserted two pieces of glass—a dark glass similar to that used in the welder's helmet and a clear piece acting as a guard. Two spot-welded or soldered clips hold the glass in place.

With the shield attached to the time study board, the observer need only raise the board a little to protect his eyes while watching exactly what the welder is doing.

Storing tools in cabinets next to machines where they are used saves steps

Saves Observer's Eyes From Weld Arc

GUY B. ARTHUR, JR., Industrial Relations Manager, R. G. LeTourneau, Inc., Toccoa, Ga.

To say it is possible to time-study electric arc welding operations closely without danger of burning one's eyes would be fictitious. In view of the fact that one quarter of our 4500 shop employees are welders, we have given considerable attention to this problem. We tried a variety of methods, none too satisfactory, before we experimented with heavy, then light, leather shields approximately 12 inches square. In each of these shields we cut a hole large enough to hold a lens from a welding hood. They provided effective protection

(Continued on page 224)

MAINTENANCE SERVICES

SELECTION • INSTALLATION • INSPECTION • UPKEEP • ORGANIZATION

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CHANGE OF ADDRESS

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MAINTENANCE as the Editors See It

Don't Let Coal Burn Before It's Under the Boiler

KINDLING ISN'T ALWAYS required to set bituminous coal afire. Given the proper conditions—and these conditions may easily come about by accident—this variety of coal can start on a career of self-destruction that may have serious consequences. That possibility is something to be kept much in mind by operating executives in plants that have recently changed from oil to coal.

Whether and how much trouble coal in storage will give depends on several factors. For example, sulphur content of the coal has much to do with its tendency to ignite spontaneously. Hence a low sulphur content is desirable. In general, the more fine dust a coal contains, the more likely it is to catch fire. Improper piling can further aggravate this tendency.

Dumping coal from a height into high piles tends to concentrate dust and fine material in the center, where their ability to make trouble will be enhanced. Danger of fire is lessened when coal is piled up in successive layers about 3 feet deep, which are leveled off and rolled. Limit the height of piles to 10 or 15 feet.

Never pile coal over a source of heat, such as steam pipes. Also, don't pile it over manhole covers or in any place where passage of air through the coal will be facilitated.

Frequent check of temperatures in the interior of the pile, or the use of an automatic indicator, will assure prompt discovery of excessive heating.

Keeping considerable amounts of bituminous coal safely in storage involves techniques and precautions whose observance will save both trouble and loss.

Set Up a Salvage Squad Before You Need It

DESPITE ALL ordinary precautions, fires may break out. Or a normally placid river overflow its banks. Or a severe storm tears off the roof, blows in skylights and windows. Less drastic, but of more frequent occurrence, a sprinkler head opens, or tanks or pipelines burst. Equipment, raw materials, finished products become thoroughly soaked. What to do?

A well-trained, well-equipped salvage squad is the most effective means of minimizing the damage that inevitably follows when machines and most materials and products get wet. With comparatively few exceptions, any plant that does not have a salvage squad organized to act promptly and intelligently when disaster strikes, is overlooking an elementary precaution that is of more than usual importance today.

When machines, materials, or products are damaged or destroyed in normal times, there are always more where they came from. Consequently the question of how far to carry salvaging operations becomes a matter of dollars and cents. Now the problem is to save hard-to-replace equipment and scarce materials.

For maximum effectiveness salvaging operations must be conducted speedily and properly, under emergency conditions. They can be carried out in this manner only when a suitable organization has been set up and trained beforehand.

Open Wiring Stages a Comeback

OPEN WIRING is one of the relics of horse-and-buggy days that can with real justification be taken off the shelf and put back into service. Once the only method of wiring, its use has been largely abandoned, since the usual practice long has been to protect power and lighting circuits by running them in iron conduit. Regardless of the advantages of a conduit installation, its extensive use of rubber and iron tends to put it in the class of a peacetime luxury.

Any scheme or design that will save scarce materials is well worth investigation. On that point open wiring scores a bullseye.

When weatherproof or slow-burning weatherproof wire is mounted on glass or porcelain insulators to serve as the neutral, the use of rubber is completely eliminated and the consumption of iron is trifling—a few pounds of screws, nails, or bolts.

There are, of course, various places where open wiring cannot replace conduit. Around machines, for example, and wherever conductors must be well protected. Again where the location of machines must be changed frequently, open wiring is likely to be passed up in favor of a bus duct system.

Nevertheless, much of the wiring now being installed is likely to be only temporary, and open work would meet every requirement. Even in installations that are presumably permanent, there are many places where insulators can well take the place of conduit. When in doubt, consult the local authority.

When properly installed in suitable locations, open wiring will give just as good service as other methods that are more costly both in money and critical materials.

Preventing and Correcting Voltage Dips

To help you maintain production schedules and insure continuous operation, here are methods you can use to eliminate voltage dips or minimize their effects

C. W. DRAKE, Industry Engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh

THE MOST COMMONLY recognized effect of a voltage dip is the drop in illumination, and frequent dips are annoying if much close work is being done—for example, drafting, accounting, or fine machine work. A 10 percent drop in voltage reduces the illumination from filament lamps by more than 30 percent. With fluorescent lighting the reduction in illumination is about 2 percent drop for each percent of voltage drop.

A large dip in voltage, of the sort that would drop out low-voltage release coils on motor starts, will cause many fluorescent lamps to go out, although they would automatically restart on voltage recovery. If this happens frequently, the life of fluorescent lamps is shortened. Mercury-vapor lamps go out on a smaller dip than fluorescent, and they usually do not restart for several minutes.

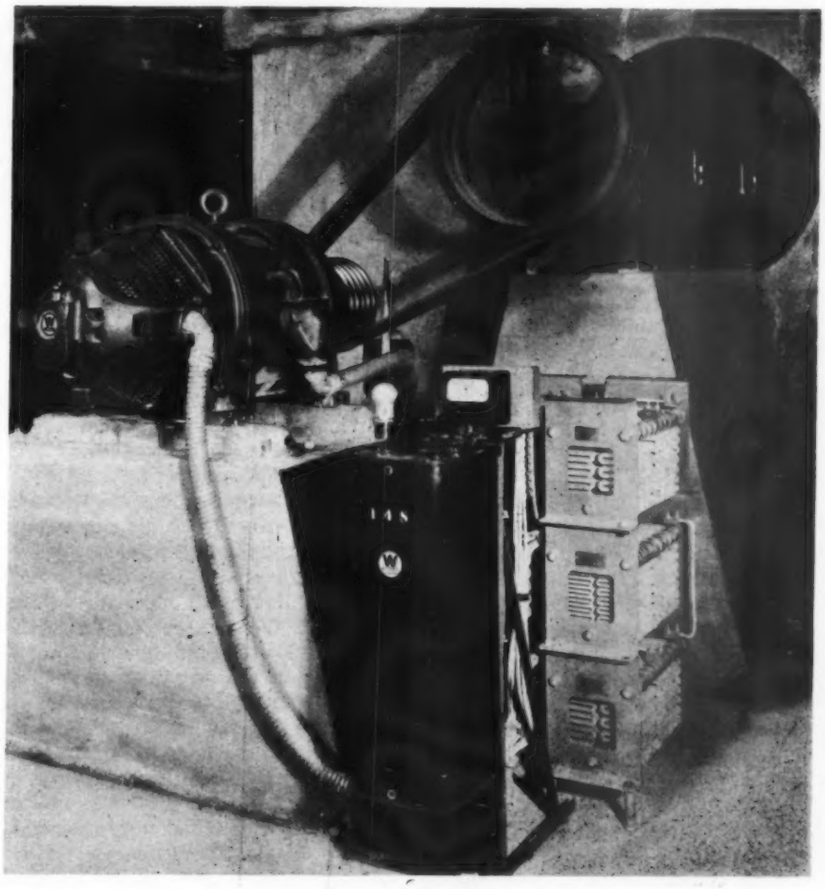
Welding Affected

The most serious effect of voltage dips is usually on some of the manufacturing processes. The shutting down of motors by the dropping out of low-voltage releases is a common effect of dips. Major changes in voltage, however, seriously affect the operation of spot or flash welding, industrial X-ray equipment, and other devices which are automatically timed and based on a rated voltage.

Most motors are started and controlled by means of magnetic, push-button-operated starters providing low-voltage and overload protection, rather than by manual starters which provide overload protection only. The drop-out voltage is indefinite after the contactors have been in service for some time. Variation in contact spring tensions, friction, and airgap adjustment causes a wide variation in the voltage at which the contactors open; although it averages 60 percent voltage on some modern magnets, many starters in service drop out at from 70 to 75 percent. Consequently, in plants where continuity of operation of certain machines is vital, steps must be taken to see that the voltage does not drop to a value to release the contactors, or to arrange the control so that the motors will not stop under conditions of voltage dip.

It is essential, however, to differentiate between dips and outages; if the power is entirely interrupted or maintained at low value even for a few seconds, nothing except another source of power can maintain continuity of operation.

A sudden drop in voltage is usually the effect of a sudden increase in load on the system and will occur in varying degree whether the power is purchased or generated. When starting a motor, the increase in current will cause a voltage drop in the feeder, depending on the total increase of load



Wound-rotor and drum controller, together with ammeter, enable operator to start fan with a minimum of line disturbance

on the feeder and the circuit constants. The change in voltage at the bus, and consequently the actual voltage at the motor terminals, depends on the type of power supply to this bus and the relative size or rating of such supply equipment to the starting kva. of the motor.

The starting kva. of the largest motor is seldom a large percentage of the transformer rating, but there are exceptions. Consider, for instance, a plant having an average load of 500 kva., being carried on a 500-kva. transformer bank, and with its largest motor a 100-hp. squirrel-cage machine. If this motor were started on full voltage, taking about 500 kva., the total load on the transformer at time of starting would be about 900 kva., but this in itself would cause a voltage drop at the transformer with sustained primary voltage of only about 5 percent below the normal voltage at full load of 500 kva.

The principal question is: What is behind the transformer? With a high capacity substation nearby, there may be only a few percent additional drop during the starting conditions, but if, as is more often the case, there are long lines connected to the high-voltage system, then the cumulative line, transformer, and internal feeder drop may be excessive. The power company generally specifies the largest motors that may be started on full voltage or the maximum kva. that any motor may take in starting in order to limit the dip in line voltage. In a well-supervised system there is little chance of having excessive dips from the starting of motors.

Dips do occur, however, at various times, more on some systems than on others, generally because of lightning disturbances, faults on the line, or switching surges, and no one solution is applicable to all cases.

Pushbutton Starting

It is assumed that for most motors the standard full-voltage starter with overload and low-voltage protection is satisfactory, and after an interruption the operator presses the start button. When manual restarting is unsatisfactory or involves too much delay, the use of a time-delay pushbutton is usually found a satisfactory solution. This pushbutton maintains the starting circuit closed for an interval adjustable from ½ to 4 seconds after loss of voltage; when the contactors do drop out, they will close again as the voltage returns to a suitable value.

The contactors may drop out at about 65 percent normal voltage and will pull in again at about 80 percent voltage if this occurs within the time-delay setting of the pushbutton. If the voltage does not return to at least 80 percent of normal during this time interval, the motor must again be started manually, since it will have stopped or reached such a low speed that manual restarting is necessary.

On synchronous motor drives, not designed to pull in under full-load conditions, the opening of the line contactors even for a fraction of a second is serious, and requires manual restarting. Several solutions are possible—for instance, the use of a.c. contactors, d.c. operated, latched-in contactors, or oil circuit breakers.

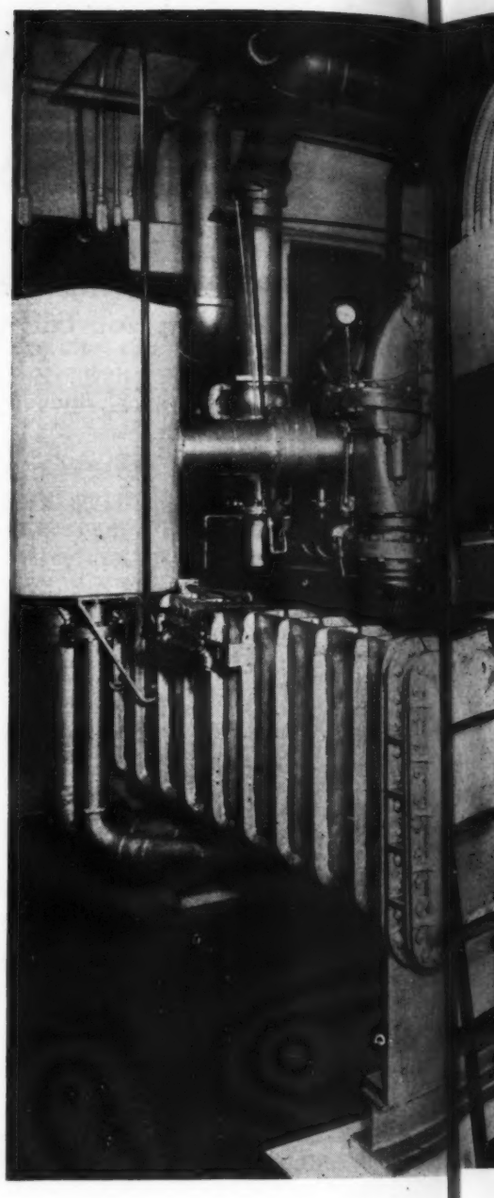
Using Voltage Relays

A.c. contactors are available with d.c. magnet coils and with an independent control circuit to hold the contactors in as long as desired. Voltage relays with inverse-time characteristics are ordinarily used for opening the control circuits so that a shorter time of operation is obtained with the larger dip in voltage. The d.c. supply may be obtained from a storage battery or from the shop supply. An a.c. motor driving a motor-generator set is subject to the same voltage dips as other motors, although the stored energy of the set may be sufficient to maintain satisfactory voltage on a d.c. system for the duration of the dip.

Latched-in contactors are magnetically closed, held in by a mechanical latch, and opened by energizing a trip coil. Such contactors maintain the motor circuit closed regardless of voltage variation, with an a.c. supply only, and are impossible to open upon power failure. It is ordinarily desirable to disconnect the motors after a definite time so that they will not restart or attempt to restart after a shutdown. This is accomplished with latched-in contactors by the use of an independent a.c. or d.c. control circuit, and time-delay low-voltage relays.

All the previous discussion refers to contactors, since they are most commonly used for the control of all low-voltage motors (600 volts or less) and, when oil immersed, for many of the smaller 2200-volt motors. On the larger 2200-volt or 4000-volt wound-rotor, squirrel-cage, or synchronous motors, oil circuit breakers are used.

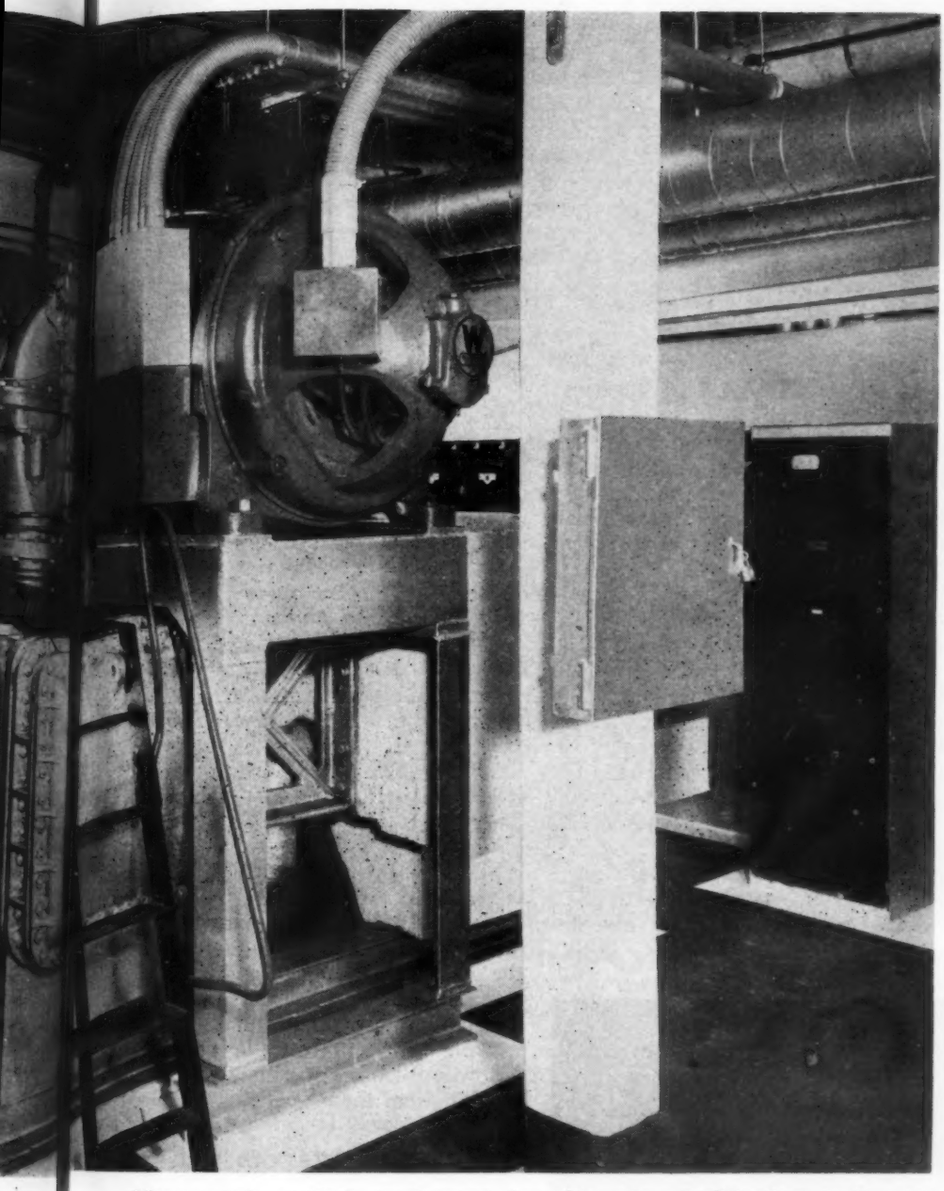
Breakers are manually or electrically operated and are held closed by a latch instead of a magnet; the problem of voltage dips is much more easily taken care of. On manually closed breakers a.c. overload and time-delay low-voltage devices are usually standard equipment. Electrically operated circuit breakers generally utilize a d.c.



circuit for closing and either or both a d.c. shunt trip and a.c. low voltage release for opening; consequently time-delay low-voltage releases or relays are readily applicable.

The aim is to hold power on the motors as long as they maintain satisfactory speeds. Continuity of operation is possible, in plants with two power sources, by shifting motors which run the most essential machines from one source to another by means of suitable relays. Relaying and transfer systems must be worked out for each particular plant.

With the source of power entirely within the plant, the proper attack is to eliminate the causes rather than to provide remedial measures. The actual voltage at the motor terminals generally depends on the power supply to the main bus, hence on the size and



Motor and control equipment for this air conditioning unit was especially chosen to prevent voltage dips and uninterrupted service

type of generating capacity. It is often difficult to appreciate, for instance, how the starting of a 50-h.p. squirrel-cage motor can cause such a decided drop in voltage on a generator of ten times its capacity; also why this voltage drop occurs even with the best voltage regulators, and why with an engine type of generator the drop is much greater than with one of the turbine type construction.

Analyze just what happens when a 50-hp. motor is started on line voltage. The locked or starting kva. will be from five to six times the full-load value, or about 250 kva. at a low power factor, perhaps 35 percent. The initial drop in voltage which occurs at a 500-kva. generator depends on its characteristics, principally its transient reactance, for slow speed generators about 25 percent against about 12 to 14 percent for turbine-type generators. For the same generator ratings and change in load, the drop in voltage will be twice as great for the slow-speed machines as for the high-speed. The initial drop is independent of regulator action, and to keep this instantaneous drop within a given value it is necessary to limit the change in load kva.

The 250-kva. starting load of the 50-hp. motor on the 500-kva. generator, of engine-type construction, would cause an instantaneous drop in voltage of 250 ÷ 500 x .025, or 12½ percent (if turbine-type, about 6 percent). This voltage drop occurs within a few cycles, but the voltage continues to drop until corrected by the voltage regulator. The maximum drop with a 50 percent load change with regulator operation may be from 20 to 25 percent depending on the speed of the regulator and the machine constants; without a voltage regulator the voltage would continue to drop to nearly one-half of normal value at this low power factor load. Consequently, if generators with 25-percent transient reactance are installed and it is desired to keep voltage dips to 10 or 15 percent, it is evident that sudden load changes of only about 25 percent of generator rating are permissible.

We might consider that the largest permissible motor is 5 percent of the generator rating; with a turbine-type generator, the largest motor is 10 percent of the generator capacity. Many plants, however, need motors larger than 5 or 10 percent of their generator rating. To maintain reasonable voltage regulation, two questions must be considered—first, the type of motor to use; second, the type of starting equipment.

One Good Solution

Wound-rotor induction motors using secondary resistance control are always a solution to these problems since at start they will give full-load torque with approximately full-load amperes, and at a high power factor. Such motors and control are more complicated and expensive than squirrel-cage motors and starters, and there are comparatively few places where they are needed. On squirrel-cage or synchronous motors the starting amperes can be reduced only by reducing the voltage at the motor terminals, and the starting torque is reduced as the square of the applied voltage—i.e., 80 percent voltage at the motor terminals gives 64 percent of the torque that is obtained at full voltage.

There is a definite limit beyond which the voltage cannot be reduced and still start the load. There are, however, extreme cases where it is desirable to apply the voltage in several steps even if the motor does not start, thus giving the voltage regulator time to correct the voltage, or, on a central station network system, to reduce the voltage dip per step to a definite value.

It has been possible here to outline only the more common methods of eliminating dips and minimizing their effects. A large number of special solutions are required to meet specific requirements.

Ready-to-go Maintenance

Repair service is organized like a big-city fire department. Electricians, millwrights, pipefitters hop to emergency calls, keep down-time to the minimum

V. C. ULDIN, Plant Engineer, Automobile Division, Studebaker Corporation, South Bend, Ind.

WE THINK of maintenance work as sharply divided into two types. The bulk of this work, and that which in the long term is most significant in its effect upon manufacturing costs, is the routine, day-by-day upkeep of the services so that production may continue smoothly. Less in volume, but always of more immediate significance than the routine maintenance job, is the emergency call that means a breakdown is blocking the flow of production.

The best comparison we can think of for this type of emergency work is a city fire department. The men and equipment may not be needed often, but when they are needed there can be no delay or fumbling. Our purpose is to have available at all times an emergency repair service that is like an alert fire department.

At the same time, we cannot afford the luxury of having our maintenance men sitting around waiting for such calls. So we have our department organized to keep the routine maintenance operations going ahead full steam, but always with the proviso that these are temporarily abandoned in favor of responding to an emergency requirement.

The central maintenance department might be likened to central fire department headquarters. The office always has at least one man on hand to answer the telephone—and we have two telephones here, just to make sure that a breakdown call does not get delayed while someone discusses a less urgent matter. Adjacent to the office are the workshops of the three principal maintenance crews affected by emergency calls—electricians, millwrights, and pipefitters.

Like any well-organized fire department, we do not depend upon a single firehouse to serve the large community which is our plant. Despite the fact that we can reach any production department from the central headquarters in five minutes afoot, or in less than that if we use an automobile, we find it advisable to have regional units on the job near where their services are most likely to be needed in a hurry. An electrician, for instance, is always on duty at his crib in the final assembly department, adjoining the office of the department foreman. If a breakdown occurs, he does not have to come from a distance. Between urgent calls, he repairs portable high-cycle tools that are used on the final assembly line.

Similarly, there are electricians and millwrights always on duty in the foundry. There is a headquarters shop in the body plant and another in the chassis plant, each with several maintenance electricians and millwrights assigned for regular service working out of there. No need to list every such point—the idea must be clear from these examples.

Electricians, millwrights, pipefitters all have in central headquarters two-wheeled carts ready loaded with tools, parts, and other equipment. Here pipefitters, with their cart, answer an emergency call

When Conveyors Fail

It happens that about 95 percent of all emergency calls in our plant arise from conveyor breakdowns. There are two reasons for this. First, the heart of any mass-production plant is its conveyor lines which pace the entire operation; hence, a breakdown halts the line, and is of major importance. Second, our union agreement provides that for any delays exceeding an aggregate of more than 15 minutes in a shift on a conveyorized production line, or 30 minutes on any other production operation, due to failure of equipment or material supply, the pieceworkers must be paid day rates if they are held and not sent home.

Consider the maintenance advantage of having an electrician right at hand when, say, the final conveyor line stops. Within 30 seconds he has left his bench and is looking

Most of the emergency calls arise from conveyor breakdowns. An electrician is never far away, and within 30 seconds he is looking for the trouble. If it is minor, he takes care of it. But if, for instance, a big motor has failed, he telephones the central office, and gives information needed for quick repairs

for the trouble. If it is minor, a fuse that needs replacing or a control to be reset, he takes care of it in a jiffy. But let us suppose that one of the big motors driving the chain has failed.

All Information at Once

Without the electrician there is always the question whether the foreman would know exactly what was wrong. He might call up and say, "There's no juice and the chain has stopped. Come over and fix it." If he knew nothing more, we should have a man gallop over, and only then find out exactly what was needed. As it is, the assigned electrician telephones the central office and gives all the information off the motor plate —size, specifications, and so on. The office man gets a millwright gang to load a spare motor from the stock stored alongside the shop, haul it to the final line with a gasoline tractor.

By the time the millwrights arrive, the electrician has disconnected the old motor, got it all ready to be horsed out and replaced by the spare. Then he hooks up the new one, and the chain resumes. We regularly make repairs of this kind in anywhere from three-quarters of an hour to an hour and a half from the moment of shutdown, depending on the size of the motor. These would not be bad times in any league, we believe.

An integral part of our emergency service is our effort to get full information the instant a breakdown occurs. At every opportunity, we urge the foremen of production departments to get the fullest possible facts to us when they telephone for help. The man who answers the telephone in the central maintenance office, or one of the outlying branches, invariably does his best to find out precisely what is needed. A call saying that a conveyor is down is not enough. We question the man at the other end: Is it electrical or mechanical? Are the telltale lights working, to show that no shutoff button has been pushed? No smoke coming from any motors? Any sign of the chain being off a sprocket? Nine times out of ten, we get the correct diagnosis thus before we start for the job.

Call Out the Reserves

On the tenth call, where we still do not know what it is all about, we really turn out the reserves. As many electricians as we can gather up on the instant—maybe only a couple of them who are on duty in the shop that day, or half a dozen if there happen to be as many at hand. At least two millwrights. The plant engineer keeps his automobile parked just outside the door, and, on such a call to a point more than a few hundred yards distant, he loads in a couple of electricians and a couple of millwrights and dashes for the scene of the breakdown. Afoot, but as fast as they can make it, come a couple more millwrights pushing a two-wheeled cart containing the miscellaneous heavy tools that experience has shown most often needed—pinch

bars, jacks, chain links, and so on.

Meanwhile, the clerk in the maintenance office has been busy. He has checked the work sheet on his desk, and called any electricians and millwrights working anywhere in the neighborhood. If he knew they were working close to a telephone, he called direct. Otherwise, he put it on the signal system so that they promptly telephoned in to report. Usually he calls the closest crews back to the central shop, and sends to the breakdown any other men who can get there in a hurry. Our maintenance men really have the firemen's spirit; they hustle.

First on the Scene

The plant engineer and his carload are usually first on the scene of such a trouble. They spread out over the area, looking for what may be wrong. If they find that something further is required from the central shop, a telephone call starts it on its way. Meanwhile the foreman has been told approximately how long it will take to make the repair. If it can be done quickly, fine. If it is a tough one that will require an hour or two, he generally sends his men home for the rest of the morning, or tells them to take their lunch hour now and come back in an hour. On the average, the maintenance department does not exceed its 15- or 30-min. allowance twice a month.

For instance, the other day the motor conveyor broke in the motor-building department. When the foreman telephoned for help, indicating a chain off the sprocket, we told him, "Okay, we'll be right over. Meanwhile, tell those two millwrights who are setting up an electric heat-treat furnace that we say to drop it and fix the conveyor." By the time the gang arrived from the central shop, the millwrights off the heat-treat job were just slipping the chain back on the sprockets. That breakdown lasted less than five minutes.

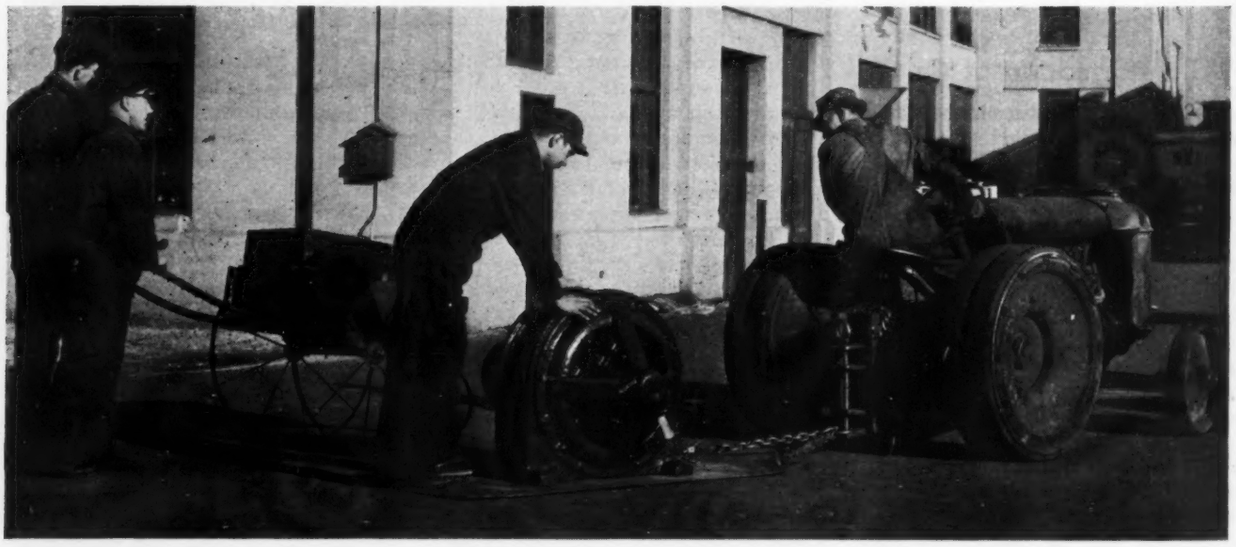
The three maintenance crafts that get emergency calls—electricians, millwrights, and pipefitters—all have in central headquarters two-wheeled carts ready loaded with tools, parts, and other equipment. The millwrights usually need their carts, the pipefitters always need them, and electricians only rarely need them on emergency jobs. Because urgent calls are relatively rare for pipefitters, and because their needs are so distinctly specialized for each job, the usual procedure on a break of a water, steam, or air line is to send out a man with only his handbag of tools, as a scout and shutoff man.

He first finds the cutoff, then clears it, so that production can resume. Then, just as quickly as possible, he gets word back to the shop either through the production department foreman or by calling in and ordering the necessary materials. If it is a simple job and the foreman can tell us on his original call that a 1½-in. air line has sheared on a tee, and that this merely needs replacing, of course we send out the tee and the simple tools by the first man. On the bigger jobs, the loaded cart arrives shortly after the word gets back of just what is needed.

At one time we talked of motorizing our equipment for emergency calls, but we eventually came to the conclusion that this would usually be more of an impediment than a help. A truck could not get in everywhere that the tools and materials are needed, while a hand cart can get right to the scene of the trouble. Also, a truck would probably be kept loaded with all the major equipment, and this might concentrate the essential tools and materials at a break distant from a second shutdown where they might be needed at the same time.

A Central Location

Moreover, our central shop for maintenance is not by accident located where it is. This point was chosen a good many years ago because it was then, and still is, right between the final assembly department and the motor-building shop. These are the crucial points in the plant, and we can reach them in a minute or two under any conditions. The other feeder conveyor lines of major significance come in toward these two departments, and are correspondingly handy to the maintenance shop. At the more distant points, such as the foundry, we maintain substation gangs that can handle almost anything likely to come up—and we can supplement them within five minutes by some brisk walking.



Millwright crew leaves central maintenance with spare to replace motor that can't be fixed on the spot

How to Get the Most Out of Electrical Equipment

R. H. ROGERS

Industrial Engineering Department, General Electric Company

ELECTRICAL EQUIPMENT ordinarily found in manufacturing plants does not demand extraordinary care to keep it operating efficiently. Like all other machines, however, it should receive proper attention. A few minutes spent each week in examining, adjusting, and servicing will assure long life and, what is more important, continuous operation.

There are five cardinal procedures to be followed in maintaining electrical equipment in plants that must operate 24 hours a day:

1. Schedule planned down-time on each unit and notify the electrical department whenever a machine is or will be down for mechanical work so that the electrical equipment can be checked simultaneously.

2. Build up and maintain a reserve of units, parts, and subassemblies so that quick changes can be made.

3. Keep spare units and renewal parts clean, dry, and in good order for quick delivery.

4. Keep records of troubles and cures as a means for running down chronic cases and finding the causes.

5. Carry out inspections as regularly and thoroughly as possible.

Check new installations of motors, controls, and replacements frequently.

FOLLOW THESE RULES AND ADD YEARS TO ELECTRICAL EQUIPMENT

1. Keep it clean
2. Keep it properly lubricated
3. Keep a regular inspection schedule
4. Don't wait for motors to squeal from lack of oil, or smoke from overload, before checking their condition
5. Know at all times the condition of the apparatus
6. Know what loads the apparatus must carry
7. Correct the weak points before they fail
8. Remember that prevention is better than cure

Some maladjustment may be discovered that would cause real trouble if a monthly inspection schedule were being rigidly followed.

Maintenance of electrical equipment differs from that of mechanical equipment in that there is seldom any advance warning of trouble serious enough to stop production. A machine indicates gradual deterioration in several ways—by noise, off-quality production, or appearance. It may be kept in operation a long time, perhaps in its final years on some low class of work. Electrical equipment, on the other hand, either does or does not work. Hence there is greater necessity for close check on the few indications of distress that may show up.

Dampness or excessive temperature and humidity will in time deteriorate the insulation of motor windings, and grounds or short circuits will occur. Particular care must be given to the frequent inspection, maintenance, and repair of motors operating under such adverse conditions.

Keep an up-to-date list of all the electrical equipment in the plant, accounting for every motor, control box, transformer, and circuit breaker, as well as cables, in terms of size and rated capacity. Set up a regular schedule of inspection so that the load carried by the electrical apparatus, as well as its condition, is known. If nothing is done until failures actually occur, they will begin popping all around, and may be serious. Find out what increased plant output will mean to electrical apparatus, and see to it that production is not stepped up to a point where electrical failures will curtail production.

Transformers, switchgear, and lighting equipment are all static in nature and are usually not exposed to as bad conditions as are found about motors and control. However, they do need attention.

Transformers

Transformers require relatively little maintenance. It is essential, however, to check for signs of excessive overloading by use of the proper instruments. In the case of oil-insulated transformers take readings of ambient temperature, load in amperes, and voltage. Transformers of the larger sizes usually are furnished with thermometers indicating the oil temperature; large power transformers may have equipment for indicating the "hot-spot" temperature of the windings.

Check transformers for oil level and condition of the oil. Despite precautions moisture may be absorbed, particularly within the first few days of operation, and it is well to test both the top and bottom oil. Draw and test oil samples at least every three months from water-cooled transformers and once every six months from self-cooled transformers of the larger sizes. If the oil tests below 20 kv., dry it by filtering. Keep oil level up to the mark on the oil gage.

Ventilation of self-cooled transformers must be adequate to carry away the heat. Check this point, particularly in case the plant layout has been changed, because the flow of circulating air may have been obstructed by the changes.

The capacity of self-cooled transformers can usually be somewhat increased by adding fans to circulate more air around the radiating surfaces; but consult the manufacturer. Recommendations for safe overloading have been established by the American Standards Association.

In general, the larger the transformer, or where continuity of service is important, the more frequent should be the inspections. Follow the manufacturer's recommendations as to details.

It is equally important to check regularly on the condition of spare transformers, if they are to be depended on in an emergency.

With water-cooled power transformers, see that the ingoing water has a temperature of not more than 25 degrees Centigrade (77 degrees Fahrenheit), and supply enough water so that the difference in temperature between the ingoing and outgoing water is not more than 10 degrees Centigrade, or 18 degrees Fahrenheit.

Nearly all cooling water will in time form scale within the coil. Scale and sediment can be removed without taking the coil from the tank by flushing with hydrochloric acid according to the manufacturer's recommendations.

Do not operate artificially cooled transformers continuously, even at low load, without the cooling medium, unless a specific rating under such conditions is shown on the transformer nameplate. Operating tem-

peratures of transformers are important. Watch them carefully, since they are often the only indications of abnormal conditions within the transformer.

Bushings must be kept clean or bushing arc-overs may result from conducting deposits. Keep transformers well painted to prevent corrosion of metal parts. This precaution is particularly important near the seacoast, because of the damp, salt air. Seal conduit pipes leading from station to terminal boxes at the transformer to prevent warm air flowing to the box and condensing.

Give transformers with synthetic, non-flammable cooling and insulating liquids similar periodic inspections. Draw samples of the liquid and test on the same schedule as transformer oil. If the liquid tests below 25 kv. at room temperature, use a filter press to restore the dielectric strength to above 30 kilovolts.

Test overload, overvoltage, differential, and such relays, used generally to protect power transformers, regularly to be sure they are operating properly.

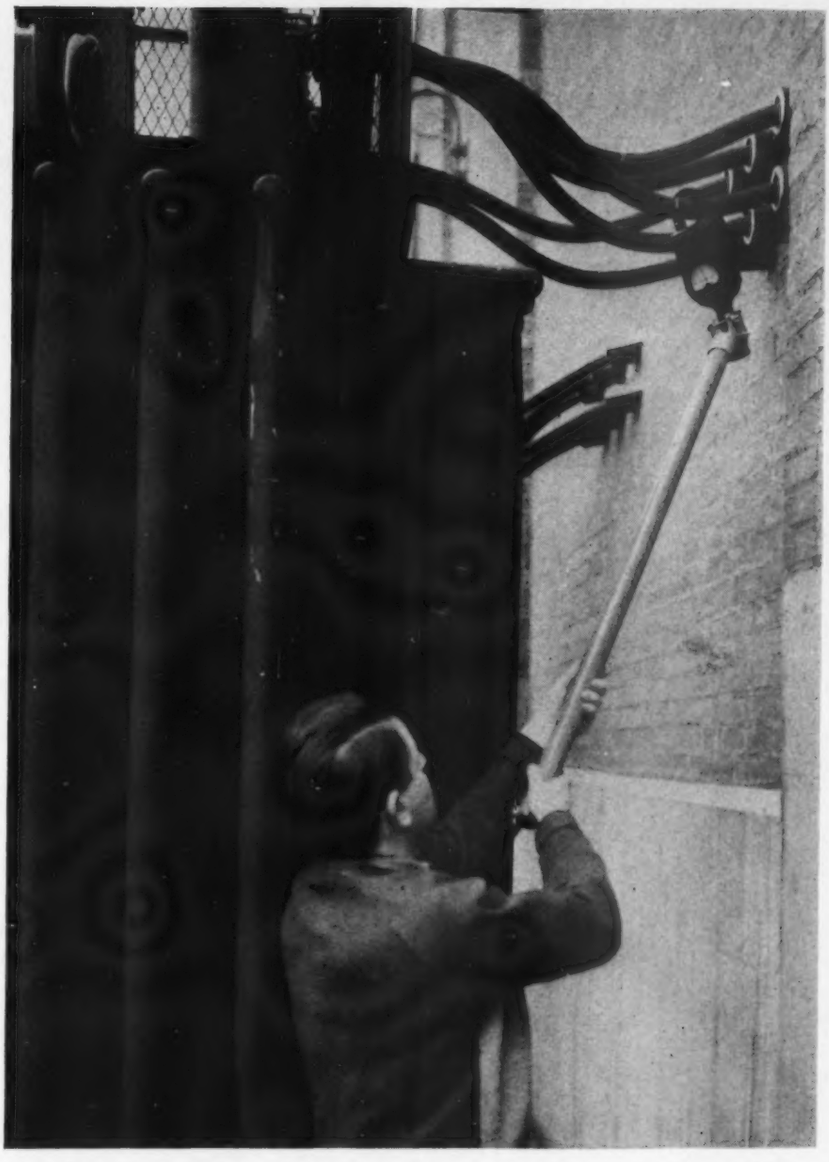
Every three months make oil tests, and see that the breather is providing free ventilation. Filter the oil every two years, or sooner if it tests low. An inspection above the core is also recommended every two years, either when the oil is withdrawn for filtering or by drawing down the oil to the top of the core. Every five years give the transformer an over-all inspection. Appreciable sludging is a warning that operating conditions are not entirely satisfactory.

Water-Cooled Transformers. Check ingoing and outgoing water temperatures weekly, and make an occasional pressures test on each section of the cooling coil. Semiannually test the water pressure and flow.

Oil-Insulated, Air-Pressure Transformers. Make monthly checks on the fan control and on the condition of motors and fans. When inspecting the fan control, check also on the operating condition of any fuses or circuit breakers in the fan circuits.

Gas-Seal Transformers. Make daily readings of the gas pressure (mercury gage) and of the volume of gas remaining in the cylinder. During the first month of operation check weekly on the oxygen content; thereafter check this feature semiannually.

Every three months test the functioning of the mercury relief valve, the gas regulator, and the minimum-pressure alarm circuit.



One thing is certain. Excessive loads need never go undetected just because transformers are hard to "get at" and cables difficult to reach. With the handy hook-on volt-ammeter it is possible for the inspecting electrician to read loads without disconnecting cables

Load - Ratio - Control Apparatus. Check hourly on the relief diaphragm. Inspect the automatic control each month, and test the oil quarterly. Once a year check the contactors, arcing ratio adjusters, stuffing boxes, the mechanism, and the ventilators. Inspect non-arcing ratio adjusters every five years.

Oil - Conservator and Gas - Seal Transformers. The relief diaphragm of the conservator type should be checked hourly—a cracked or broken glass diaphragm permits moisture and air leakage.

Test the oil quarterly; inspect above the core every five years. Give the transformers an over-all inspection every seven to ten years.

Air-Blast Transformers (Indoor). Check hourly on the ingoing and outgoing air temperatures. Blow out the transformers with dry compressed air at least weekly—more often if the transformers are in dirty locations.

Forced-Oil Transformers. Check hourly on the pump glands for air and oil leakage; and weekly for the in and out temperatures of the forced oil, and for stoppages in the cooler screens.

Switchgear

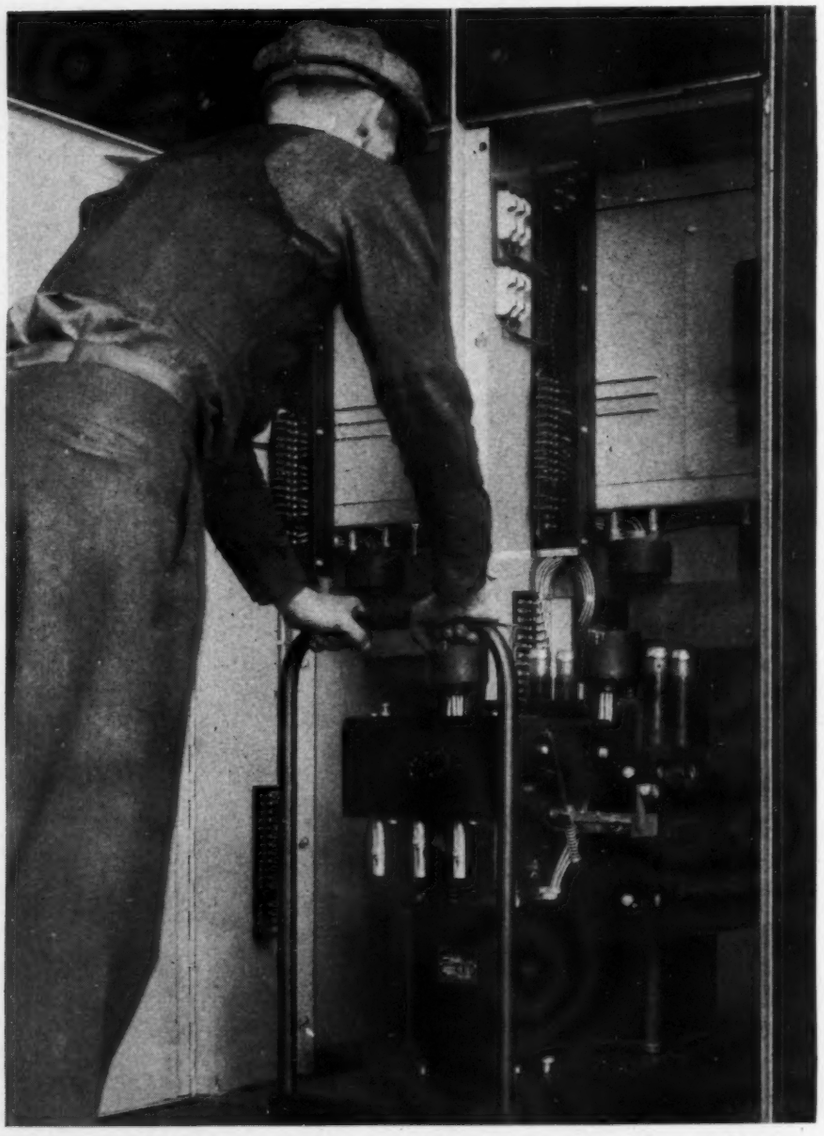
Switchgear requires a minimum of maintenance, but periodic inspection and some servicing are necessary if it is to continue functioning with full efficiency. Attention required depends on several factors, such as type of equipment, severity of service, and kind of installation. Old equipment will, of course, require more frequent and more detailed inspection than new. Inspect at least once a year, more frequently if service is severe.

Oil Circuit Breakers. The inspection and servicing of oil circuit breakers are alike for generator and feeder breakers. There are not many things to be done, but they are important.

Be certain that the adjustments of the operating mechanism have retained their setting since the previous examination. Slowly open and close the breaker by hand to make sure there is neither binding nor excessive friction. Inspect the alignment of both stationary and movable contact members, to be sure that contacting is made properly. When testing or operating the breakers without oil, or when tanks are removed, coat the contacts lightly with vaseline to prevent damage to their surfaces.

Copper contacts, almost universal in older equipment, tend to acquire a coating of oxide as a result of continuous service with maximum load. The oxide, distinguishable by its dark brown color, has a high resistance and should be removed with fine sandpaper. Smooth contact surfaces that have been roughened by arcing.

Examine oil and make sure that it is clean and at the proper level in the tank. Visual inspection of the oil is not sufficient to determine whether its dielectric qualities are adequate. Despite discoloration the oil may not necessarily be low in dielectric strength. Similarly, clear oil may contain sufficient moisture to bring it below a safe operating point. Therefore give the oil a dielectric strength test. Filtering is usually sufficient to recondition it.



To say that it becomes daily more difficult to replace electrical equipment, is understatement indeed. Modern switchgear is easy to "get at" for the regular cleaning that is now more vital than ever before

Air Circuit Breakers. Copper contact surfaces of air circuit breakers require frequent cleaning with fine sandpaper, since the copper oxides form much more rapidly in air than in oil. Corrosive fumes may accelerate oxidation of the surfaces. At regular inspection periods (as well as after adjustment) operate the breaker a few times to check the proper functioning of all parts. Electrically operated breakers should be operated first manually, then if found to be okay, a few times electrically.

Disconnecting Switches. Disconnecting switches require occasional removal of oxide deposits from their surfaces; also, inspection to make sure that a good contact is being maintained—at least 85 percent of the contact area. A disconnecting switch that is operated frequently requires less attention, because the oxide film is cut through, thereby retarding the cumulative heating.

Most modern switchgear equipment has many features facilitating inspection and maintenance. For example, the entire breaker with its operating mechanism as a unit, can be removed from some types for inspection or repair, and a spare unit easily and quickly substituted.

Cumulative heating has been eliminated in newer equipments by silver-facing the copper contacts and other current-carrying parts. Although little or no attention is required by the silver surfaces, the arcing contacts must

be watched for roughness. If they become so burned away that main contacts open simultaneously or later, arcing will destroy the silver plating.

Whenever possible locate switchgear where there is a minimum moisture and fumes. Moisture condensation will cause short circuits, grounds, and corrosion on the switchboard surface and on the attached apparatus. Avoid locating switchgear equipment near pipes that may drip condensation. Vaseline or lacquer is of much help in preventing corrosion of the copper and in protecting the buses and connections. Take care to keep such materials away from contact surfaces and out of bearings.

Switchgear requires little, but thorough, attention to keep it in good working order. Tanks only partially filled or containing badly carbonized oil, and bushings that are gummed with dirt may under sudden overvoltage cause a flashover—and an outage that could have been prevented by periodic inspection.

Lighting

In some plants there is the possibility of corrosion of the lighting equipment. This tendency can be minimized by wiping a thin grease over the edges, beads, and similar portions of reflectors that are most likely to be attacked.

Generally speaking, lighting equipment in extremely dirty locations needs to be cleaned every three or four weeks. Under average conditions periodic cleaning every two to six months is usually sufficient to maintain the equipment at close to full efficiency. One way of determining how frequently the equipment should be cleaned is to make periodic checks with a lightmeter, and clean the equipment when the lighting intensity drops to two-thirds of its initial value. Having determined with such measurements how fast the lighting drops, it will not be necessary to make further rechecks, because the cleaning schedule can be set up on that time basis.

Decreased efficiency of lighting equipment usually goes unnoticed for quite a while, since dust and dirt accumulate on lamps and reflectors more or less uniformly and relatively slowly. Lighting intensity of a good installation can often drop to one-half its original value before workmen are conscious of the decrease.

Guard Against Splashing

Soap and water are usually to be recommended for cleaning lighting fixtures, although sometimes they are objectionable because of the possibility of wetting material or equipment below. Cleaning agents that contain wetting compounds can then be used. These materials reduce the possibility of splashing to a minimum.

Cleaning is best done by taking the reflector down and washing it thoroughly with a detergent and warm water. Since porcelain-enameled reflectors essentially have a glass surface, alkaline detergents can be used in cleaning them. Take care in cleaning aluminum reflectors, because an alkali will tend to attack the metal. Neutral detergents are recommended for such reflectors or, even better, a liquid wax or wax emulsion. These materials effectively remove the dirt and have the added advantage of leaving on the surface a thin film of wax that helps to retain the reflectivity.

Many of the new large-area, low-brightness, industrial units have a white casein-base paint for a reflect-

Unless there is a definite maintenance schedule, plant illumination may easily be reduced by 50 percent in no time at all. Check lighting regularly and clean fixtures as often as conditions demand it

ing surface. This surface can be washed two or three times with mild soap and warm water. After these cleanings, however, the surface tends to lose its reflectivity and a fresh coat of paint should be sprayed on.

Shortens Life

Wiping the reflectors with a dry cloth at the time lamps are replaced is extremely poor practice, particularly where there is greasy dirt that will adhere to the surface. Not only is it impossible to clean the reflector thoroughly in this way, but it is also inadvisable from the standpoint of long life of the reflector.

Heavier lighting loads are being carried by some plants as a result of increased appreciation of the importance of more light. Two-wire, 115-volt lighting circuits might profitably be converted to the three-wire (Edison) 115/230-volt system, with the two active conductors of the 115-volt system used as the outside conductors of the three-wire system and an added conductor of smaller copper cross-section serving as the neutral.

Light output of tungsten filament lamps falls off very appreciably with undervoltage. It is likewise important with fluorescent lighting that the voltage be maintained within approximately 7 percent of rated value. Hence, it is important that the voltage of the lighting system be well regulated. It may be necessary to install an air-cooled automatic induction regulator, rated at the voltage of the lighting feeder, to compensate voltage supply plus the voltage drop for the regulation of the incoming through the plant wiring.

Mercury Arc Rectifiers

Steel tank mercury arc rectifiers are water cooled. If the raw water available for cooling contains mineral salts and other impurities, corrosion or incrustation will occur in the raw water system, which will reduce the heat transfer efficiency between the rectifier and the cooling water.

Make a periodic examination of the water systems and remove any incrustation or products of corrosion. If the rectifier is equipped with water-to-water heat exchanger, inspect the raw water section regularly (monthly) and when necessary clean it thoroughly in accordance with the equipment manufacturer's instructions.

Check Cooling Jackets

When the rectifier is cooled by direct application of raw tap water, inspect the cooling jackets for incrustations monthly.

Remove any appreciable amounts of incrustation. Two methods may be used, and it may be necessary to resort to both if the cooling system is in bad condition.

1. The water jacket of multi-anode type rectifiers can be opened at the handholes and the jacket and the vacuum chamber scraped free of sediment. Then flush out with water. This type of work is so well known that further description of the cleaning operation is unnecessary.

2. Chemical treatment can be used; the following is suggested:

Take the rectifier out of service, but leave the water heaters connected. Add 2 percent by weight of a recommended alkali, such as sodium metasilicate, to the water in the system.

Circulate this solution in the water system for from 24 to 48 hours. With the heaters, maintain the solution at 50 degrees Centigrade during the cleaning period.

Raw water is usually used directly to cool the mercury vacuum pumps. Inspect these cooling systems monthly, and remove any deposits. Drain the cooling jacket or cooling coil of the mercury condensation pump and the cooling coil of the pipeline. Fill these coiling coils with the same alkali cleaning solution, keeping the temperature between 50 and 60 degrees Centigrade for 24 to 48 hours, to remove any scale that may have accumulated.

After the above procedure, flush out the jackets thoroughly with clear water to remove all sediment and traces of the cleaning agent.

Corrosion in the water chamber of the power rectifier and in the cooling system can be retarded by the application of sodium dichromate if a recirculating system and heat exchanger are available. Add a sufficient amount of the orange-colored sodium dichromate crystals to the water in the cooling system to make an 0.5 solution. The crystals are readily soluble and should be placed in the system and the coolant circulated.

Look Out for Salts

Various salts in the water, especially chlorine, will reduce the corrosion-inhibiting efficiency of a solution to a considerable degree. For this reason use an ample concentration, which will more than compensate for any salts present in the water.

It is recommended that the sodium dichromate solution be renewed annually, in addition to periodic tests to assure the proper corrosion-inhibiting qualities.

Change the vacuum oil of the rotary oil-sealed vacuum pump once a year, whether the pump runs continuously or intermittently. After the old oil is removed, clean the case thoroughly before new oil is poured in. Replace the rubber parts of the valve plunger, if they have become softened as a result of contact with oil or oil vapor.

Clean the Vacuum Pump

In operation the mercury condensation vacuum pump needs practically no attention. If it fails to function properly, check the amount of water flowing in the cooling coil. Also, check the heater. Very dirty mercury may stop the operation of the pump. Any trace of oil in the pump stops proper operation. If oil gets into the pump, it must be cleaned out with ethylene bichloride. Pure grain alcohol can be used to clean water from the pump.

At the lower end of the nozzle assembly, mercury returns to the boiler between the boiler wall and the nozzle separator. Check this space for stoppage. Clean mercury should easily return through it.

After a long period of operation of this pump, three months or more, check operation of the thermostat to see that it functions properly. Internal inspection of the pump is not necessary unless its functioning appears impaired.

Do not allow the pump temperature to go above 150 degrees Centigrade. Manufacturer's instructions should be followed if it is necessary to open the pump to renew parts. In every instance make it a point to use new gaskets after vacuum joints have been opened.

Rotating Equipment

Rotating electrical machines whether motors, generators, converters, condensers, or motor-generator sets, have many things in common when it comes to getting maximum life out of them.

Alignment and Connections. Electrical machines that are mechanically connected to other machines must be checked for alignment if they are removed and replaced after overhauling.

Solid couplings may be checked with feelers before bolting up, and shims placed under the feet if needed to get the coupling halves to touch all around. To give long life, a flexible coupling must be accurately lined up so that the flexible feature will come into play only later on if slight misalignment comes from long use.

Carefully line up pulleys and sprockets for flat belt, V-belt, or chain drives to prevent excessive wear, distortion, and bearing heating. Run belts and chains slack enough to show a decided sag. Run the slack side at the top if possible.

Windings. The windings of electrical machines require considerable attention. Remove the accumulated dust and dirt at regular intervals by vacuum cleaning or by blowing out with a blast of dry, low-pressure air.

If the insulation is greasy or grimy clean it with a solvent, such as tetrachloride, used sparingly.

Windings that are exposed to acid or alkali vapors or to excessive humidity may require special varnish treatments with bakings at low temperatures to prevent gradual breakdown of the resistance.

If possible, provide barriers, walls, or covers for old equipment to protect it as much as may be from bad surroundings. Newer machines usually provide better protection.

Clean and dry immediately any electrical machines that have been exposed to flooding, rain, or excessive moisture. Measure insulation resistance of the stator winding with an insulation-resistance meter. This value should be not less than: *Megohms* = *Rated voltage* ÷ (0.75 × *Hp. Rating*) + 1000.

If insulation resistance is lower than this value it is advisable to dry out the moisture in one of the following ways:

1. Bake the unit in an oven at a temperature not exceeding 90 degrees Centigrade until the insulation resistance becomes practically constant.

2. Inclose the machine with a canvas or similar covering, leaving a hole at the top for moisture to escape, and insert heating units or lamps.

3. Pass current at low voltage through the windings. Increase the current gradually until the winding temperature, measured with a thermometer, reaches 90 degrees Centigrade. Do not exceed.

Bearings. Sleeve-bearing housings are provided with liberal settling chambers in which dust, dirt, and oil sludge collect. The only cleaning necessary is to remove the drain plug and drain the oil, which will flush out most of the settled material with it.

Whenever a motor is disassembled for general cleaning, the bearing housing may be washed out with a solvent such as carbon tetrachloride. Dry the bearing lining and cover the shaft with a film of oil before assembling.

For sleeve-bearing machines fill each sleeve bearing reservoir to gage level with a good grade of mineral oil while the unit is stopped. For average indoor temperatures viscosi-

Shafts of rotating equipment can be built up when worn, repaired when broken, or even extended—all by electric welding. Above, shaft extension is being built up by the electric welding process

Left, an improvised metal shield guards against spattering alkali. Right, windings of motor must be varnished frequently to save them from the acid fumes exhaled by the nearby pickling tank

ties SAE 20 or SAE 10 are suitable, but turbine oil is preferable to the automotive type.

Ball-bearing motors are shipped with bearing housings packed with grease. The length of time before grease needs to be added depends on operating conditions.

Machines with ball bearings are equipped with pressure gun grease fittings and pressure relief plugs which, if used according to instructions, provide convenience in greasing. Add grease as often as operating conditions demand with a hand-operated (not pedal- or air-operated) pressure gun as follows:

1. Wipe clean the pressure gun fitting and the regions around the fitting and relief plug.

2. Remove relief plug.

3. Free the relief hole of any hardened grease.

4. Add grease with the motor running until it is expelled through the relief hole. (If fittings are not safely accessible with motor running, grease may be added sparingly with motor at rest.) Adding until new grease is expelled purges the housing of old grease.

5. Run the motor for a few minutes with relief hole left open to expel excess grease.

6. Clean and replace relief plug.

Exclusion of dirt from the housings and the lubricant is important. Use a good grade of grease with the following characteristics:

1. Consistency a little stiffer than vaseline with minimum change over operating temperature range.

2. Melting point preferably above 150 degree Centigrade.

3. Freedom from separation of oil and soap.

4. Freedom from abrasive matter, acid, and alkali.

Since the method of greasing ball bearings tends to purge the housing of used grease, removal of all grease is required infrequently. Whenever the motor is disassembled for general cleaning, however, clean the bearings and housing of old grease by washing with carbon tetrachloride.

Commutators and Brushes. After overhauling a d.c. machine, check the adjustment of brushes and brush rigging for any disarrangement. To obtain proper spacing of the brushes, set up the studs with brush holders in place, wrap the commutator with a long strip of paper covering its whole circumference, and tie the strip in place. Mark the lapping point of this paper; then remove it, spread it on a flat surface, and step it off with a large pair of dividers into sections, equal in number to the number of poles. Then replace the strip on the commutator and adjust the studs so that the toes of the brushes on the studs just touch these marks.

Check the parallelism of the studs and commutator segments. All brush holders should be at the same distance from the commutator, not more than $\frac{1}{8}$ inch at the inboard and outboard ends, and the toes of all brushes on one stud should line up with the edge of one segment.

Stagger the brushes so that they will not groove the commutator.

Sand new brushes to fit with medium or fine sandpaper. Do not use emery cloth or an emery stone, because the particles will bed in the copper. Lift the brush as the sandpaper passes under it in the direction opposite to that in which the commutator revolves. This method of sanding will minimize the length of time that the machine must be run light before load may be put on.

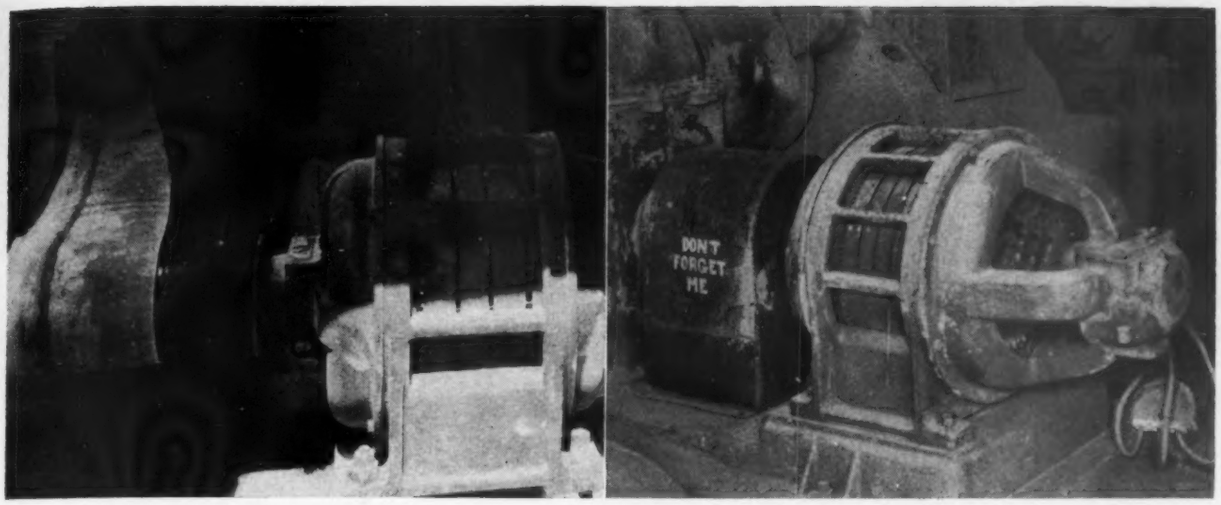
Adjust the brush pressure by means of the springs. Pressure should be approximately 2 pounds per square inch of brush contact surface for machines of relatively large size, and about 3 pounds per square inch of contact surface for machines of smaller size.

Brushes of commutating-pole generators are usually shifted slightly forward or ahead of the mechanical neutral in the direction of rotation, to insure a drooping voltage characteristic at lower voltages. The mechanical neutral may be determined from the factory marks on the armature slots and commutator bars.

Turn the armature over until the two slots that are painted red are directly under the center lines of two commutating poles, or equidistant from them. If there are no commutating poles, turn the armature until the two painted slots are midway between the two main poles or equidistant from them. The center of the group of commutator bars that are stamped and painted red on the ends indicates the mechanical neutral.

In some instances neutral is marked by a straight line drawn across the yoke and bearing with an arrow indicating direction of rotation.

The brushes of non-commutating-pole machines require some forward lead for generators, backward for mo-



Abnormal mechanical conditions (left) take heavy toll, must be corrected. Right, this motor drives a cement kiln where ambient temperature is very high. Hence the admonition: "Don't forget me"

tors, which is indicated by a mark on the brush yoke.

On machines where double brush holders are used, set the face of the holder tangent to the commutator at a point midway between brushes. Proper setting of the brush holders should result in a small clearance between the toes of the brushes. If the toes of the trailing and leading brushes press together, improper riding of the brushes on the commutator will result.

If the commutator is polished, the unit may be loaded at once, provided the insulation resistance is satisfactory. If the commutator is not polished, run the machine light for several hours in order to secure a high, uniform polish on the commutator surface and a good fit of the brush faces.

Use no lubricant on the commutator either during the polishing period or subsequently. When first put into service, self-lubricating carbon brushes may in some instances leave a black deposit on the commutator. Wipe off this deposit as rapidly as it appears with a piece of dry canvas or other hard, non-linting material wound around a block.

When good commutation cannot be obtained, looked over the following mechanical features, checking the commutation after any change is made and noting the effect produced:

1. Inspect all contacts and make certain that none is loose.

2. Check the connections and make certain that the commutating field or any part of it is not reversed, and that no main spool is reversed.

3. Check the brush spacing and alignment. Machines of certain designs are very sensitive to brush spacing, and variation of more than $\frac{1}{16}$ inch should be corrected. In general the more accurate the brush spacing, the better the commutation.

4. Check the mechanical neutral and try shifting the brushes each way from neutral. Very often a slight shift is advantageous.

5. Inspect the brushes and see that they move freely in the holders, and that the pigtails do not interfere with any part of the rigging. Check the pressure and see that the fit is good. Look for burning or roughness of the contact surfaces.

6. Inspect the surface of the commutator and wipe off any blackening. If the commutator is rough or eccentric, causing the brushes to chatter or move in the holders, it must be ground or turned.

7. Check the centering of the commutating poles between the main poles. Also check both the main and commutating-pole airgaps.

Collector Rings. Keep these rings clean and maintain their polished surfaces. Ordinarily the rings will require only occasional wiping with a piece of canvas or non-linting cloth. Do not let dust or dirt accumulate between collector rings.

See that the brushes move freely in the holders and at the same time make firm, even contact with the collector rings. The pressure should be between 2 and 3 pounds per square inch of brush surface.

When installing new brushes, fit them carefully to the collector rings. Be sure that the copper pigtail conductors are securely fastened to, and make good contact with, the brush holders.

Induction Motors. Squirrel-cage a.c. motors have few parts and require the least maintenance of any. Many types and classes are available and if properly applied, stator windings and the bearings sum up the parts that will need attention. Old open motors, applied where some sort of inclosure would be used now, will require more frequent and more detailed attention. Adequate ventilation is important in that it keeps the ultimate temperature down if the load and ambient temperature will allow.

When the airgap of a sleeve-bearing motor, as measured with a tapered airgap gage, is less than the minimum valve given below, the bearing linings may need replacement:

Frame Number	*Minimum Airgap (Inches)*
203 to 326 inclusive.....	0.008
364 to 559 inclusive.....	0.014
561 to 579 inclusive.....	0.020

Ball bearings do not wear gradually; if they fail, they do so completely in a very short time. Therefore, there is no need to check airgap on a ball-bearing motor.

Direct-Current Motors. Faulty operation of d.c. motors, particularly after being overhauled, is most often caused by faults in the field circuit.

Bolted contacts may heat if the contact surfaces are not clean and smooth and bolted together with sufficient pressure. See that the contacts of connecting strips for pole-face windings and other connection strips are tight. Imperfect contact

may be a serious contributing factor to bad commutation.

Check the field connections with the connection diagram, and then independently according to the following rules: In motors, commutating poles have the same polarity as the main poles which precede them in the direction of rotation. Arrows on the spool collars indicate the direction taken around the spool by the conductors connected to the corresponding terminals.

A reversed field connection can usually be detected by the residual voltage tending to approach zero when the field switch is closed.

The airgap should not vary over 12 percent either way from the average value. Check the connections with the connection diagram, and check the polarity by separately exciting the field and holding two iron rods against adjacent pole tips all the way around. The free ends of rods should attract each other. With a steady current flowing through the field, take the drop on each spool separately with a voltmeter. A variation of more than 9 percent in the drop indicates a faulty spool.

Excessive temperature on the commutator is usually caused by:

1. Heavy overloads for prolonged or frequent periods.
2. Sparking.
3. Too high brush pressure.
4. Poor condition of commutator.

A blackened or roughened surface increases the brush friction and the contact drop, both of which cause increased temperature rises. Always use a thermometer to measure the actual temperature rise of a commutator.

Brush Shifting A.C. Motors. Upon replacing the motor after overhauling, be sure that the setting of the brush yoke mechanism and the connections between the brush holder and stator leads are correct for the direction of rotation desired.

On motors that do not have radial fans, see that blades are adjusted for the direction of rotation desired.

Make sure that no oil or other foreign material is on the commutator; that all other parts are clean; and that bolts, nuts, and screws are tight. Oily material on the commutator is likely to render the motor inoperative and to damage the commutator seriously.

Shift the brush yokes and see that their movement is not obstructed; also, that none of the pigtails on the brushes of one yoke touches any part of the opposite yoke. Brush holder leads should not rub against either the arms of the end shields or any moving part of the motor, but should permit full travel of the brushes.

Check the limit switch settings. The pilot motor brush shift should be checked to be sure that the limit switches stop the pilot motor.

See that the collector cover is kept in place, both as a personal safeguard to keep operators from contact with the line voltage which is on the collectors, and to keep the rings clean.

Periodically remove the cover and inspect the brushes and rings. Remove any dust collecting on collectors, studs, or holders. Do not remove or replace the cover with voltage on the motor, because the cover might make contact with live parts and cause a short circuit.

Keep the creepage surfaces between the brush holders and collectors painted with compound. See that the rings maintain their polished surface.

Synchronous Motors. Give collector rings and brushes the same careful attention given commutators, in order to obtain and maintain good polished surfaces. Stagger the brushes across the ring to minimize grooving. To prevent the formation of slivers, brushes must not extend beyond the edges of the rings.

Where operating conditions are severe, collector ring surfaces can at times be kept in better condition by occasionally changing the polarity of the brushes. Make the leads to the collector brushes or at the switchboard long enough to permit this reversal of polarity.

Where the stator and rotor are independently supported, as on compressors, be sure that the airgap (which is liberal in this type of a.c. motor) is uniform as nearly as possible at each pole. As the bearings of the driven machine wear, the airgap will change and should be corrected as indicated by regular periodic inspections.

Overheating of any member may be caused by excessive current; an open phase or unbalanced a.c. current resulting in single-phase components of current; improper ventilation or unsufficient air; excessive ambient temperature; unequal airgap; short-circuited windings; reversed field coil; dirty condition; open-circuited field; or wrong field current with synchronous motors.

Give machines that have been repaired after running in service a high-potential test of 1½ times normal voltage.

Motor Control Equipment

Controls may operate many times a day, hence it is vitally important that they be inspected regularly and that replacements or repairs be made quickly when necessary. As with all electrical equipment it is of course necessary to assume here that the control device under consideration has been properly selected, installed, and adjusted.

Prevent any accumulation of dirt, oil, grease, or water on the operating parts of controls.

Use protective paints on the stationary iron parts, and insulating varnish of the proper characteristics for the coils. If the air is saturated with moisture or contains corrosive gases, inspect and paint the various control parts from two or four times a year, depending on the severity of the operating conditions.

Heaters or lamps within the controller inclosure will prevent condensation of excessive moisture. For best results, such heaters should be energized continuously, especially when the controller is not being used.

Circuit Breakers. Operate circuit breakers or contactors by hand from time to time to make sure that all the clearances are normal and that parts are working freely. Should parts become worn so that adjustments cannot be maintained, install new parts. Need for adjustment and cleaning, as well as renewal of the tips, depends on the frequency of operation of each device. With contactors, clean and check the armature for free working and for the condition of the magnet contact surfaces.

Make an occasional inspection of all nuts and connection wires on panels and resistors, particularly when subject to vibration. Inspect flexible pigtail connections periodically, since

they are made of finely woven wire. In extremely corrosive atmospheres such connections have been known to fall apart before there was any readily apparent indication of failure.

Give float switches the best of care, especially if they are of the moving-contact type. Adjust and line up the tips properly and clean if any indication of excessive corrosion is noted. Correct immediately any tendency of the bearings to bind.

In float switches of the mercury-contact type the mercury tubes must be held tightly in place. If the tubes are becoming dark, it may be an indication of air leakage and the tubes should be renewed.

Contactors. A contactor has several bolted or spring-closed contacts. Excessively high resistance at these contacts will cause very high temperatures, even though the contactor is carrying rated current or less.

The most likely point of high resistance is where the movable tip makes contact with the stationary tips, but high resistance may occur at any of the several bolted joints on the contactor. If a contactor begins to develop an excessive temperature, use a millivoltmeter to determine which of the several joints has a high-voltage drop across it. An a.c. millivoltmeter is now available for checking the voltage drop on a.c. contactors.

When the copper contact or contacts with excessive drop across them have been located, open the contact and remove the oxide with a file (not with sandpaper or carborundum paper). High resistance will most commonly be found in the active contact. It is a simple matter to inspect these tips weekly or monthly and, if the temperature is unduly high, to file them a bit.

The foregoing comments apply particularly to copper contacts because they oxidize readily, and the copper oxide formed has a very high resistance. A file will remove the oxide and reduce the resistance to a low value again.

If sulphur gas is present, a high-resistance film will develop quite rapidly. To prevent this action, mount the contactor in a tightly gasketed inclosing case, or immerse it in oil.

Sometimes it is not practicable to keep the resistance of contacts low by filing them. When it is desired or necessary to maintain a low resistance of the active contact without servicing, a silver face can be brazed to each tip so that the contact is made through that metal. The silver will oxidize, but when heated silver oxide reverts to the metallic form so that silver contacts are self-cleaning.

Electrical interlocks may fail to operate because of copper oxidation, or sometimes because dirt lodges between the contacts. Use of one hemispherical and one flat tip of silver will overcome both of these troubles. The point of the hemispherical tip will make contact without trapping dirt particles between it and the flat tip, and the use of silver will overcome the oxidation trouble.

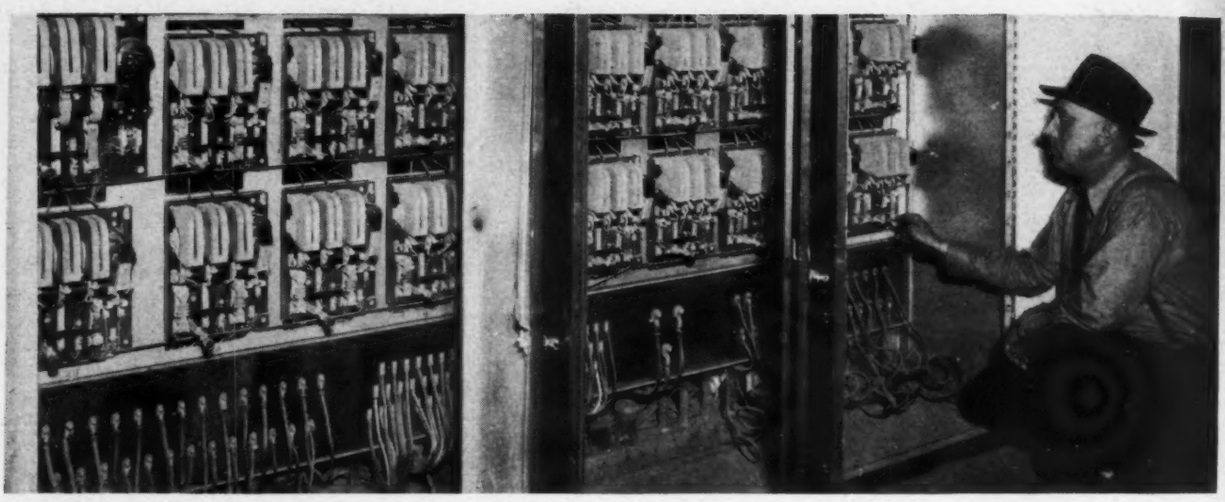
Excessive wear on the contact tips of a contactor indicates frequent operation. Silver should not be used for such contacts, since it does not stand up so well as copper under this severe service. If the service is unusually heavy, and if the root-mean-square of the current is not more than equivalent to three-fourths of the contactor's rating, the tip can be faced with an alloy that will last several times as long as copper tips. This material is expensive, but its use is sometimes warranted.

A roughened tip will carry current as well as a smooth tip. If a large projection should appear on a tip because of unusual arcing, it should be removed. A tip roughened by ordinary arcing need not be serviced.

An a.c. magnet or solenoid supplied with constant-voltage excitation requires a large inrush of current to close the armature, after which the coil current drops to normal. If armatures do not close because of excessive friction or for other reasons, the large inrush current may burn out the coil within a few seconds. Such mishaps can be prevented by the use of a thermal cutout, which opens if the armature fails to close. It is only necessary to replace a small link made of two pieces of metal held together by low-melting-point solder.

Resistors. These parts may be of porcelain-tube, enameled, open-wound,

Check magnetic control equipment periodically for such vital things as loose connections, worn contacts, and burned barriers. A small amount of attention may save a serious loss of production



To minimize outages, maintenance men must familiarize themselves with control circuits under their care

strip-wound, cast-grid, or other construction.

In cast-grid resistors the current passes from one grid unit to another across a ground face. Too much current flowing across these ground surfaces may develop high resistance and destroy the joint. To overcome this difficulty, clean the joints and parallel the current path. This procedure will reduce the current in the middle joints, where the trouble is most likely to develop.

Edge-wound or strip resistors usually have their terminals either brazed or welded to the strip, thus preventing excess resistance at the joint. To provide an adjustable contact, a clamp-type terminal is sometimes furnished. Such a resistor may become hot at this point and a bad contact may develop. The best cure is to braze the terminal at the proper position.

High-resistance cast grids having a small cross-sectional area may break, especially if mounted on machines that vibrate severely. The best solution is to use an edge-wound resistor that is non-breakable and made of corrosion-resisting material capable of withstanding very high temperatures without scaling.

Relays. Many types of construction are employed for relays and they are designed for a wide variety of applications. Some operate as a function of time, as exemplified by the dashpot type in which movement of a solenoid is retarded by a dashpot. The kind of trouble inherent in a dashpot was a primary reason for the development of the other types of timing relays. A dashpot is essentially a close-fitting device that is easily affected by dirt, gumming of the oil, and corrosion of the close-fitting parts. Also, the torque of the magnets varies with the position of the solenoid armature in its coil.

If trouble is experienced because of tripping while starting a motor or shortly after getting up to speed, three things can be done:

1. A heavier oil may be used if the relay almost holds.

2. A starting contactor can be used that does not include the overload relay in the circuit. After the motor is up to speed, the running contactor can close and the starting contactor can open, connecting the overload relay into the circuit. This arrangement is somewhat complicated, but is sometimes used.

3. The relay should just trip if placed in a 90-degree Centigrade (195-degree Fahrenheit) ambient, or in a pail of water held at that temperature. If a relay does not function correctly, immerse it in a pail of water kept at 90 degrees Centigrade and adjust it. Do not make the adjustment by bending the thermoflex strip. If this method of checking or adjustment does not provide the necessary degree of protection to the motor, it can be assumed that the relay heater is not of the correct size.

A temperature-overload relay is sensitive to temperature and should not be put in a strong draft such as that from a window or circulating fan. If it is necessary to place it in such a position, shield it by a cover.

Conversely, do not locate a temperature-overload relay above a source of heat, such as steam pipes. In brief, keep the relay in an ambient temperature that does not differ greatly from that of the motor.

A time-delay relay is used for controlling the rate of acceleration of motors and for many other functions where a short time delay is needed. In the escapement type of relay, a pendulum is used as the governing means. Therefore it is necessary to mount the relay in a definite position with respect to the motion of the pendulum. It is not always possible, however, to mount the relay in the proper position, and when it is in the out-of-true position it is less dependable. Shortening the pendulum makes it possible to tip the relay more from the vertical, but the shorter pendulum results in a shorter time delay.

A new design of time-delay relay has a balanced pendulum, and variation in time is obtained by changing the length of the stroke. In principle the two devices are the same, but mechanically they are different.

If the older-type escapements fail to time properly, check their mounting position. When the application is such, however, that it is difficult to mount and keep the relay in the proper position, consider use of the balanced type.

Corrosive Atmospheres. Corrosive fumes rapidly attack the metal parts of control devices and render them inoperative. To overcome this trouble a control should be applied that has its operating parts immersed in oil in a container capable of withstanding the corrosive atmosphere. When control devices are of such nature that it is impracticable to oil-immerse them, equipment inclosed in a case with a tight, gasketed cover should be applied. Protect the inclosing case with a suitable corrosion-resisting paint.

The Enemi

A

WATER

STEAM – from process, leakage, exhaust

EFFECT—Condenses on cold surfaces — corrodes. Weakens insulation

DEFENSE—Stop steam leaks. Conduct process steam away by fans. Otherwise protect electrical equipment by barriers or use totally inclosed motors and control

VAPOR – fog, excessive humidity

EFFECT—Gradual penetration of insulation; accumulation of water in inclosures is the result of sweating

DEFENSE — Install adequate ventilating equipment to keep humidity down. Give coils frequent varnish treatments. Use heaters in idle units. Use inclosed apparatus

SPLASH – rai snow, wash-d

EFFECT — Water acc on bottom coils. Fl occur. Tubes and b broken

DEFENSE — Provide that admits ventilating splashproof or inclose Instruct operators to in washing down

DUSTS

ABRASIVES

EFFECT—Excessive cutting of commutators, brushes, and collector rings. Speeds up bearing wear, mechanical cutting of insulation

DEFENSE—Dust elimination by

MAGNETIC – cast-iron and steel dusts

EFFECT—Fine sharp particles bore into insulation, urged on by stray fields. Breakdowns and burn-outs follow

DEFENSE—Thorough sealing of winding interstices with varnish

CONDUCTI

EFFECT—Carbon, bra num, and other soft m cause shorts and flash

DEFENSE — Electrical ment should be cle quently with waste an

nies of Electrical I

And How to Combat Them

SH – rain, wash-down

Vater accumulates coils. Flash-overs es and bulbs are

Provide covering ventilating air. Use or inclosed motors. rators to use care down

FLOODS – fresh, salt, muddy

EFFECT — Insulation breaks down coil to coil or to ground. Salt is persistently hygroscopic. Sand and grit cause abrasion

DEFENSE—Wash out and start low temperature drying as soon as possible. Keep temperature below 70 degrees Centigrade. Use external electric or fuel heat, or put low current through windings. If salt present, it may be necessary to rewind. Clean oil wells to eliminate grit

ACID – splashing or vapor

EFFECT—Breaks down some types of insulation. Corrodes metal parts such as thin protecting covers. Detrimental to lubricants

DEFENSE—Special acid-resisting varnish treatments are available for protecting windings. Bright metal parts may require lacquer treatment. Cast-iron cases and covers may be required. Asphaltum paint is highly acid resistant

ALKA or vap

EFFECT—C duces insul rodes alum

DEFENSE – treatments protecting quer alumi

DUCTING

rbon, brass, alumi- ner soft metal dusts and flash-overs

Electrical equip- i be cleaned fre- waste and carbon and windings

EXPLOSIVE

EFFECT—Aluminum and magnesium dusts may be explosive. Flour-mill and elevator dusts are highly dangerous

DEFENSE—Special motor and control design for explosion-proof guarantee may be re-

NEUTRAL

EFFECT—Talc dust, textile lints, or paper fluff clog ventilating ducts, interfere with lubrication. Textile lint and paper fluff are highly inflammable

DEFENSE—Special motor de- signs mitigate clogging ratio

CUR CON

EFFECT—C dizes contac Shortens life ment, is cau

DEFENSE— ments for o age conditi

l Equipment

em

CHEMICALS

ALKALI – splashing or vapor

FECT—Cuts varnishes, re-ces insulation values. Cor-es aluminum parts

FENSE — Special varnish atments are available for tecting against alkali. Lac-er aluminum parts

EXPLOSIVES – gases and vapors

EFFECT—Dangerous to life and property. Start fires that ruin much electrical equipment

DEFENSE—Use explosion-proof motors and controls. Large units are filled with inert gas under pressure. Take ventilating air from safe distance from source of danger. Pay special attention to seals of furnaces with inflammable gas. Firewall protection is often used

OILY VAPOR

EFFECT—Condenses on insulation, causing rotting and breakdown. On many surfaces it holds dirt and thereby causes flashovers

DEFENSE—Special oil-resisting treatments are available for windings. Frequent cleaning of metal surfaces is required. Carbon tetrachloride may be used sparingly

HEAT

CURRENT IN CONDUCTORS

ECT—Chars insulation, oxy-s contacts, deteriorates oil. rtens life of electrical equip-t, is cause of most outages

ENSE—Check with instru-ts for overloads, bad volt-conditions, low power fac-

AMBIENT – general or nearby source

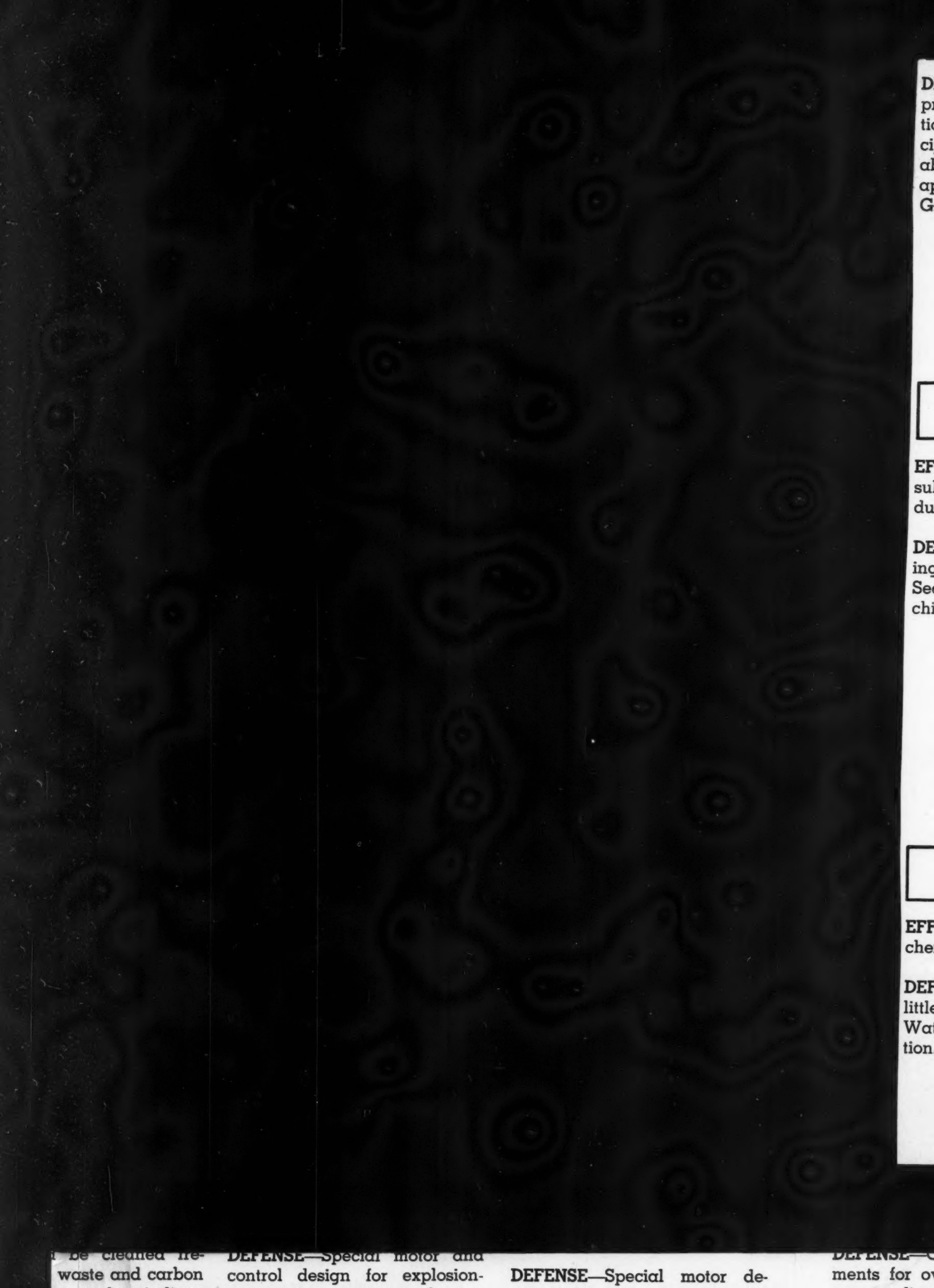
EFFECT—Overheats electrical equipment by radiation and convection. Causes bearings to run hot. Class A insulation may be charred. Early breakdowns likely

DEFENSE—Use barriers to

BAD ORDER or improper operation

EFFECT—Overheats bearings, commutator, rings, or windings

DEFENSE—Rigid and frequent inspection of motors, connecting means, and driven machine will ward off bad adjustments. Instruments will serve to locate



DEFENSE—Dust elimination by proper inclosures, by air conditioning, or by electrostatic precipitation may be required to abate trouble. Totally inclosed apparatus may be required. Give best care to bearing seals

DEFENSE—Thorough sealing of winding interstices with varnish is required. Fill all crannies where metal can lodge with plastic compound. Inclosed apparatus may be required. Blow out frequently. Use plenty of ventilation

ment should be cle
quently with waste an
tetrachloride, and
should be blown clea
low-pressure air str
closed apparatus ma
quired in some cases

OIL

GREASE

EFFECT—Accumulation dissolves some insulations. Collects dirt and conducting dusts, causing shorts and flash-overs

DEFENSE—Instructions for greasing bearings are usually available. Follow them. See that old grease is removed. Clean machine and see that it is kept clean

LUBRICANT

EFFECT—Excess oil is bad for insulation, may cause sparking; collects dirt; is obviously wasteful

DEFENSE—Oiling is usually done too frequently. Instruct oilers to watch gages and to fill only when machine is stopped. Clean up all excess oil

DEPLETION

CHEMICAL

EFFECT—Gradual changes in essential chemicals may lead to expensive failures

DEFENSE—Batteries require expert care. A little neglect can cause expensive trouble. Watch rust-inhibitor solutions for deterioration. Watch solutions in slip regulators

METALLIC

EFFECT—Electronic action and electrolytic and electrochemical effects depend upon metals, and deterioration causes failures

DEFENSE—Check vacuum tubes with instruments as coming failure is indicated in plenty of time. Rectifiers of various kinds are subject to slow deterioration; only by frequent checking and inspection can continuous service be assured

ENSE—Check with instru-
nts for overloads, bad volt-
conditions, low power fac-

downs likely

DEFENSE — Use barriers to

means, and driven machine
will ward off bad adjustments.
Instruments will serve to locate

be cleaned fre-
waste and carbon
, and windings
lown clean by dry
air stream. In-
ratus may be re-
me cases

DEFENSE—Special motor and control design for explosion-proof guarantee may be required if metal dust is fine and explosive by nature. Removal by ventilating air or duct system may reduce hazard

DEFENSE—Special motor designs mitigate clogging action of lints and fluffs. Blow out regularly with dry low-pressure air stream. Reduce amount of dusts by ventilation or ducts

ments for
age condit
tor. Elimi
current or
tion to red
safe values

DRIP

EFFECT—Oil and grease drips or is thrown on floors, belts, other machines, and on products, causing rejects. May cause accidents to plant personnel

DEFENSE—Where oil and grease are wasted, floors become saturated and dangerous. Good housekeeping demands a thorough cleanup and change of methods. Fire hazard, danger to personnel, and spoilage are the penalties for neglect

POOR LUBRICATION

EFFECT—Too much or too little lubricant, wrong kind, or contamination by grit or water cause excessive friction with wear, waste of power, and forced stops

DEFENSE—Where oil rings are used they should turn freely; inspect frequently. Waste lubrication requires cleaning the wool and picking it apart. Use best quality of lubricants; follow instructions. Watch for signs of excessive friction

ulation,
is obvi-

too fre-
ges and
. Clean

N

PRESSURE-VACUUM

EFFECT—Where successful operation depends on maintenance of certain pressure or vacuum, even slight defects may cause total failure

DEFENSE—Many pieces of equipment carry pressure or vacuum. Any variation from standard indicates a trend toward failure. Keep records and consult them

IMPACT

EFFECT—Broken parts result from falling or things falling on them, by collision with moving equipment, or by blows from flying pieces

DEFENSE — By having proper storage places provided, breakage can be largely reduced. Put all material not in use away where it belongs. Keep highways for vehicles unobstructed. Use screens where material may fly

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l upon
ures

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ated in
s kinds
nly by
n con-

ENSE—Check with instruents for overloads, bad voltge conditions, low power fac-. Eliminate source of high rrent or apply forced ventilan to reduce temperatures to fe values

downs likely

DEFENSE — Use barriers to ward off external heat. Lower air temperature by ventilation. Reduce loading. Move equipment away from local heat source

means, and driven machine will ward off bad adjustments. Instruments will serve to locate bad conditions

FRICTION

OUT OF ADJUSTMENT

EFFECT—Fits set up too tightly, lack of end play, tools or wheels dull, belts too tight, make heavy loads and cause maintenance troubles

DEFENSE — Tests with instruments will show up bad adjustments if they cause extra loading. Checking the common points of bad adjustment eliminates chronic cases. Driven machine may be at fault, or its equipment may need renewing

OVERWEAR

EFFECT—Excessive friction load may come from worn bearings, throwing gears or shafts out of line. Commutators or rings may be badly worn

DEFENSE—Check alignment of couplings, gears, shafts as worn bearings may cause overloads or breakdowns. Check air gaps as rubbing rotor and stator can wreck a motor in a few minutes. Check loads with instruments

ACCIDENTS

RUNAWAYS

EFFECT — Rotating apparatus may run away and be wrecked by centrifugal force

DEFENSE—Keep controllers, control details, and brakes in good condition where overhauling or no-load condition can occur

STALLING

EFFECT—Stalled equipment may burn out from overload or friction heat

DEFENSE—When a motor is stalled, overcurrent should open the circuit unless provision is made to cut down applied voltage. Check operation of safeguards. A machine may stall and the motor may still run if belted, if breaker is set too high

Scheduling Maintenance for Three-Shift Operation

VARIOUS SHIFT SCHEDULES for production workers have been shown in preceding issues of FACTORY. Arranging shift schedules for the maintenance department presents different problems. Hence plants frequently have to modify standard schedules to meet maintenance requirements with the manpower available.

Here are some of the maintenance shift schedules in effect:

Farrel-Birmingham Company, Inc.

In those occupations requiring Sunday service the men are assigned a day off during the week so that there is at least one man off every day, but no one day with more men off than any other day. This day off was started on a rotational basis; that is, a man who has Sunday off in a given week takes Saturday off the next week, Friday the week after, and so on. Later some changes in this schedule were arranged by the men themselves with their foremen. Because of home conditions some men prefer a certain day over others as their day off. The schedule is still set up on a rotational basis with the men switching days among themselves, with the foreman's approval, to meet their own personal conditions. Every man gets one day off each week, of course, but that day is not often Sunday.

In view of the amount of work at this plant where different trades have to cooperate and overlap their activities, there are very few places outside the power house where a complete crew is maintained on a 24-hour basis. That is particularly true on the third shift, at which time there is only one electrician available for emergency use.

In the power house two different schedules are maintained. For boiler firemen there is a rotating schedule in which four men cover the three shifts, one man working on the same shift for six consecutive days, after which he has two days off and then starts back on the next following shift for six consecutive days. Then he has two days off and goes on the third shift for six days. This schedule works out so that in the course of eight weeks each man will have received overtime twice. There is one man off duty every day and that man, of course, is available to be pulled in for emergencies if some other man is absent.

This scheduling arrangement has proved to be very satisfactory for 24-hour operation, but it requires every man's service on every shift, and the electrical power house operators objected strenuously since they preferred to stay on one shift. To get around this situation several standby power-house operators who are normally employed in the electrical department take one shift a week in the power-house to give the regular operators a day off. These same men are available for emergency service.

Each trade has at least one lead man, in addition to the foreman, who serves in the capacity of a straw boss to handle his particular unit or gang. Among the electricians, for example, there is one such man charged primarily with electrical maintenance of each of the major departments, in addition to which there is one general lead electrician and, of course, a foreman over him.

It is not difficult to arrange the schedule so that one of these lead men is always available and can act in the foreman's absence on his day off or on night shifts.

All the foremen live reasonably close to the plant and have their telephone numbers posted in the gatehouse as well as the power house, so that they can be called in at any hour should an emergency occur.

Revere Copper & Brass, Incorporated

In the majority of its plants maintenance employees work on a 24-hour basis broken down into three eight-hour shifts. Because of the nature of the work performed, it is necessary that a certain percentage of employees be on duty Sundays in addition to the regular six days each week.

So far the schedule provides that the maintenance employees will work every third Sunday unless there is an emergency breakdown, in which case full crews may be required.

It has been Revere's experience that most of the maintenance men prefer to work seven days because of the overtime payments amounting to time and a half for all hours in excess of forty.

Ingersoll Milling Machine Company

Key machines have been working around the clock seven days a week for nearly a year. The maintenance crews work the same shift as the key machines, so that in the event of a breakdown there are always enough repair men working to take care of the emergency.

Work is carried on by three shifts that alternate weekly. Each man works four days for eight hours a day and two days for twelve hours a day. On the 12-hour day one shift stays off. With this arrangement no man works more than six days in seven and, of course, no one works more than 56 hours a week.

American Type Founders

This plant is operating partly on a double-shift, 54-hour plan and partly on a triple-shift, 53-hour schedule. The maintenance department also operates on this schedule.

This shift schedule gives the employees 53 hours a week. Each works a maximum of six days a week. Every employee is free one day each week and has one Sunday off in three weeks.

Each employee works 11½ hours for two days of each week and approximately 7½ hours for four days of each week. (The varying schedule for the second week is for the purpose of making even hours of work for each shift and allowing a minimum of 10 hours off.)

The greatest number of days that any employee will work before he has a day off is eight, which will occur only once in three weeks.

The problem of obtaining maintenance men to cover these three shifts was approached by spreading some of the more highly skilled or experienced day maintenance men over the three shifts, and filling in the vacancies with less experienced men.

MAINTENANCE SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary maintenance accomplishments. Accepted articles will be paid for

To have a junction box that's big enough design the box, then multiply by two

Make Them Bigger and They'll Suit Better

GILBERT LINDGREN, Electrical Foreman, Hudson Valley Fuel Corp., Troy, N. Y.

A good sign to hang up in the engineering department as a reminder is "Make That Junction Box Larger!"

The box at the left in the photo was first installed. Later we added what we thought would be ample space in the box at the right. Now we have bricked up part of a window to make room for still another box.

•

Made Their Own Scrap Breaker

SOURCE — Hobart Brothers Company, Troy, Ohio

A Canadian plant making shells found that scrap dealers would accept the long turnings from the lathes only if they were broken into small pieces. Experiment showed that the turnings could be broken when bent at a 45-deg. angle by running them through gears.

Since a suitable scrap breaker could not be found, it was decided to make one. A discarded rotary blower bought at a local scrapyard was converted into a scrap breaker by replacing the rotors with gears. These gears were made of standard 10-in. pipe, 36 inches long with 1x½x36-in. bars welded around the outside to form the teeth. A hard-surfacing bead was then applied to each tooth top to prevent excessive wear. Two 10-in. disks with 6-in. holes were welded inside the pieces of pipe 14 inches from each end, for stiffeners.

Hubs were made from 6-in. round steel 4 inches long with a keyed hole to fit the shaft which had been removed from the rotor. They are held in place by four pieces of 2x4x¼-in. mild steel welded together as shown in the drawing.

The hopper was made of ¼-in. plate arc welded together and bolted to the top of the blower housing. The breaker was mounted on an angle-iron frame about 18 inches high so that broken cuttings can be shoveled out easily from underneath. A 7½-hp. motor geared down to 80 or 90 r.p.m. furnishes the driving power.

This home-built scrap breaker proved so successful that three more were made. The largest has 22x84-in. gears and stands 8 feet high.

•

To keep guard towers and houses comfortable in winter, an Eastern manufacturer installed natural—and forced—convection electric heaters in each and thus eliminated cost of steam piping to remote points as well as loss of heat from such pipes.

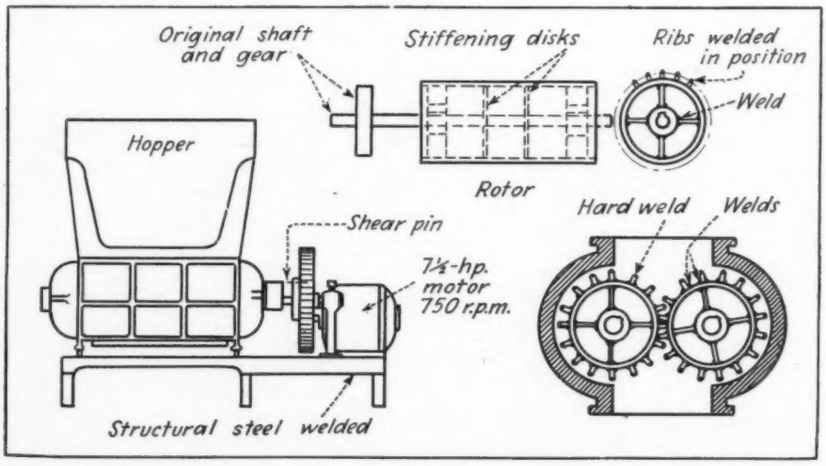
•

Aligned Motor, Got Rid of Commutator Burning

LIONEL A. HUNT, St. Catherines, Ontario, Canada

Misalignment or distortion in fixed or flexible couplings can cause motor troubles whose origin is difficult to trace. For example, a d.c. motor, direct-connected to a pump, was plagued with commutator burning. Careful checking for every imaginable fault showed that the motor was in perfect condition, but serious blackening of the commutator continued. At last the motor hold-down bolts were loosened while the unit was running and a slight vibration, accompanied by a muffled knocking sound, was noticed. After the motor was carefully aligned, and the bolts tightened, all vibration and noise disappeared. No further burning of the commutator has occurred.

On another motor, brush chatter and



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YOUR SCRAP will help WIN

AND HERE'S OUR PRESCRIPTION FOR BATTERY CARE!

1. Keep adding approved water at regular intervals. Most local water is safe. Ask us if yours is safe.
2. Keep the top of the battery and battery container clean and dry at all times. This will assure maximum protection of the inner parts.
3. Keep the battery fully charged—but avoid excessive over-charge. A storage battery will last longer when charged at its proper voltage.
4. Record water additions, voltage and gravity readings. Don't trust your memory. Write down a complete record of your battery's life history. Compare readings.

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THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

frequent breaking of pigtails were traced to a slightly distorted rigid coupling. Breakage of pigtails was stopped by forming them into complete loops, while chatter was ended by replacement of the coupling.

•

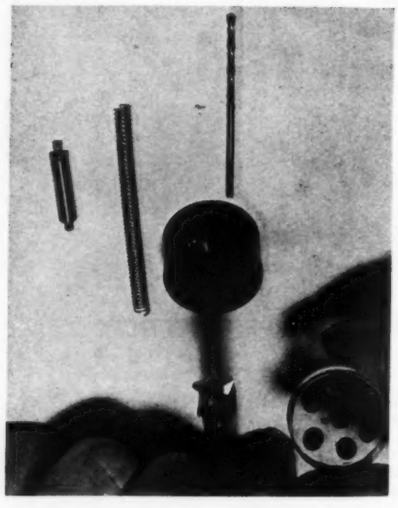
Solvents and paint left continuously inside paint spray hose extract pigment and other materials from the inside thus destroying the hose from within and discoloring paints flowing through. To avoid this the hose should be cleaned with mild solvents and blasts of air after each use.

•

Tubular Drill Quickly Cuts Test Samples

SOURCE—Westinghouse Electric & Manufacturing Company, East Pittsburgh

Use of a tubular drill saves much time in securing solid test samples from castings,

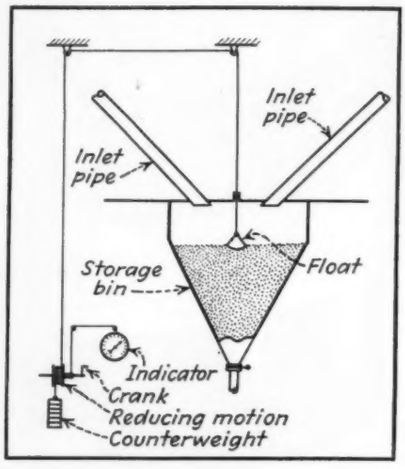


forgings, and other parts. Another important advantage is that such samples can usually be obtained without weakening the part under examination. Also, the surface material at the outer end of the sample is preserved for inspection and test.

The drill is essentially a tubular member having a number of cutting teeth at one end. It contains a removable centering device consisting of a pin and spring inside the hollow shaft. It is held in the chuck of an ordinary electric or air-driven drill, which is operated in the usual manner.

When taking a sample, a pilot hole approximately $\frac{1}{8}$ inch diameter and $\frac{1}{8}$ inch deep is made with a standard twist drill. The tubular drill is then clamped in the chuck and the spring and centering pin are placed in it. The centering pin is positioned to extend beyond the drill teeth and the nipple is inserted in the pilot hole. When the drill has cut into the piece about $\frac{1}{16}$ inch it is withdrawn to permit the pin and spring to drop out. The hole is then drilled to the desired depth. The solid core formed inside the tubular drill is removed by flexing it until it breaks off at the base.

•



Indicator Shows Level of Materials in Bins

S. H. COLEMAN, Roanoke, Va.

To determine the level of dry materials stored in bins or other compartments some kind of indicator is required. One type (shown in the drawing) is nothing more than a sounding device arranged so that its float can be raised or lowered at will. A reducing motion transmits travel of the float suspension cable to a conveniently located indicator dial. Level determinations with this system must of course be made intermittently and the float fastened up out of the way while not in use to prevent its being submerged under inflowing material.

•

Hose is often destroyed by being bent in a small arc or by being subjected to constant strain or abrasion at certain points. One way to remedy this is to insert at those points a short piece of hose, coupled at both ends, which can be replaced at any time and so prolong the life of the longer sections.

•

Wooden Spring Facilitates Planing

GEORGE HOLMAN, Marissa, Ill.

It is sometimes difficult to plane surfaces at exact right angles on jointers. This can be more easily accomplished by use of the wooden spring shown in Figure 1. The spring, made of oak, walnut, or other hard wood, is attached to the jointer by means of a C clamp, as shown in Figure 2. It should be clamped tightly to the table, with the space between the knob end and the jointer guide about one-half to two-thirds the thickness of the board to be planed. More than one spring may be used. They will keep the opposite side of the board snugly against the guide, while yielding enough to let the board slide freely over the blades.

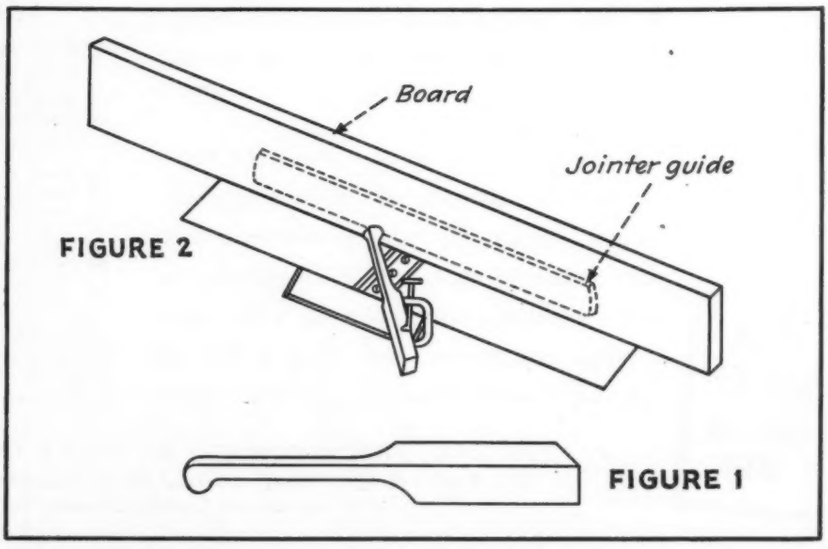
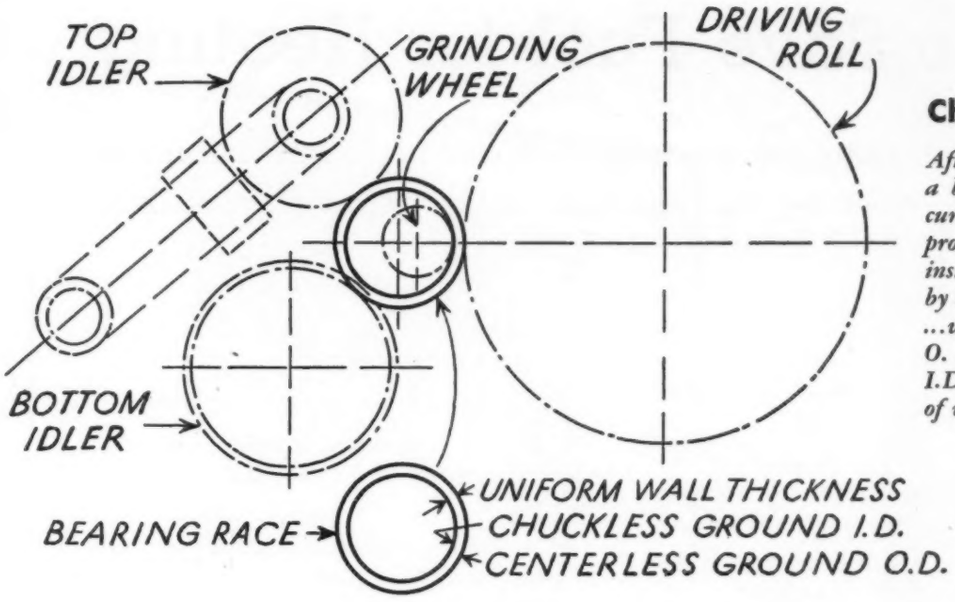


FIGURE 2

FIGURE 1

Hyatt's Gift To Industry Ten Years Ago Is Helping To Win The War Today!



INTERNAL GRINDING
Chuckless Method

After the outside diameter of a bearing race has been accurately ground by our improved centerless method, the inside diameter is controlled by our own chuckless method ...which utilizes finished race O. D. to produce concentric I.D. with absolute uniformity of wall thickness.

CHUCKLESS GRINDING is helping to speed up America's war effort... make precision manufacture possible at a mass production pace . . . and avoid material waste.

This entirely new grinding method was invented by Hyatt nearly twenty years ago. Our races have been produced by this precision process ever since.

Later, this great advance in grinding technique was made available to all industry.

Therefore, in addition to helping us make more and better Hyatt Roller Bearings for war machines, this gift from Hyatt helps other vital plants speed the day of an ultimate American victory.

Hyatt Bearings Division,
General Motors Corporation,
Harrison, N.J., San Francisco,
Chicago, Detroit, Pittsburgh.

THE 50TH YEAR OF **HYATT *ROLLER BEARINGS***

How to Save Fuel for Heating

Steps to take in reducing waste of heat and fuel to the minimum will be determined by the answers to the following questions

The Boiler

1. Is it of correct capacity for the service?

2. Is it designed for efficient absorption of heat produced from the fuel burned?

3. Is it being fired at the rate at which efficiency will be highest?

4. Are the boiler and accessories adequately insulated?

5. Are heat-absorbing surfaces clean? Is the boiler free from scale?

6. If the boiler is oil-fired, can it be converted to use coal? (Such a change is desirable from from the standpoint of reducing consumption of oil, of which there will likely be shortages in some areas.)

7. If wood or other combustible wastes are available, could they be utilized to meet all or part of the plant heating requirements?

8. Regardless of the fuel used, is the boiler operating so that maximum efficiency is obtained?

The Radiation System

1. Are all pipes, mains, and risers properly insulated?

2. Are any lines not now in use still connected to the system?

3. Are any radiators or pipe coils not now needed still connected to the system?

4. Are all unit heaters and radiators clean and in good condition?

5. Are any radiators undersize or oversize?

6. Do any obstructions interfere with movement of heated air from unit heaters or radiators?

7. Are all unit heaters and radiators properly located to heat the area served uniformly and to the desired temperature?

8. Are all traps and accessories in good condition and functioning properly?

9. Are steam lines properly equipped with air vents? Are these in good condition?

10. Are all lines properly pitched and clear?

11. Are unit heaters controlled by thermostats?

12. Are radiators or pipe coils controlled automatically? If not, is supervision over manual control adequate to prevent overheating and waste?

13. Have temperature requirements for each department or area been carefully worked out? (Temperatures suitable or necessary for different types of work vary over a considerable range. The tendency frequently is to heat workplaces and other areas to a temperature that is higher than necessary or even desirable, with resultant waste of heat. It may be possible to lower temperatures appreciably without causing discomfort or loss of efficiency.)

14. Have the possibilities of using waste heat from furnaces, ovens, diesel engines, and other equipment been thoroughly canvassed?

15. Are temperatures reduced as low as pos-

(*Continued on page 140*)

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- Cold Springing
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- Pressure Loss Chart
- *Flow of Flashing Mixtures
- *Steam Flow Through Pipes
- Properties of Pipe
- Dimension Tolerances for Welding Fittings and Flanges
- Pressure Ratings for Flanges
- Physical and Chemical Requirements for Flanges
- Pump Capacities
- Hardness Conversion Table
- Gas Density
- Table for Gauging Horizontal and Cylindrical Tanks
- Conversion Tables
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How to Save Fuel for Heating (*Continued from page 138*)

sible or economical when the plant or any departments are shut down?

16. Are all lines properly equipped with valves so that steam can be shut off when the heating equipment supplied by these lines is not in use?

The Temperature Control System

1. Is the temperature control system adequate for the conditions? Does it prevent overheating at any time or place?

2. Are thermostats sufficiently sensitive to maintain within close limits the temperatures at which they are set?

3. Are all temperature-controlling devices in good condition?

4. Are thermostats properly located and free from exposure to either hot or cold drafts?

5. Are thermostats locked or protected against tampering, or can the setting be changed according to any worker's whim?

The Building

1. Are there any broken or cracked lights in windows or elsewhere?

2. Is calking around windows, doors, or other openings in good condition?

3. Do window ventilators close tightly?

4. Is it practicable to dispense with window or other ventilating fans and block the openings? (If not, it is usually possible to install hinged louvers so that the openings will be closed when the fans are not in operation.)

5. Are there any cracks of openings in exterior wall surfaces?

6. Is it feasible to install storm sash in office and other areas where comparatively high temperatures must be maintained?

7. Have the advantages of using weather-stripping been considered?

8. Are there unneeded exterior doors or windows that might be walled?

9. Is it feasible to install vestibules for exterior doors? (If not, storm doors will help to cut heat losses.)

10. Are there adequate provisions on loading platforms to prevent entrance of cold air when doors are open? An inclosed loading platform, or a vestibule between the shipping rooms and the platform will prevent loss of a large amount of heat.

11. Is it feasible to apply insulation to walls or roof?

12. Are there any unused openings in the roofs?

13. Do roof ventilators remove more air than necessary to maintain healthful or comfortable conditions?

14. Is it feasible to block off skylights or monitors?

15. Is it feasible to block off space below the roof by installing a ceiling?

16. Do doors and windows fit tightly in penthouses, elevator shafts, and stairwells. Is glazing in good condition?

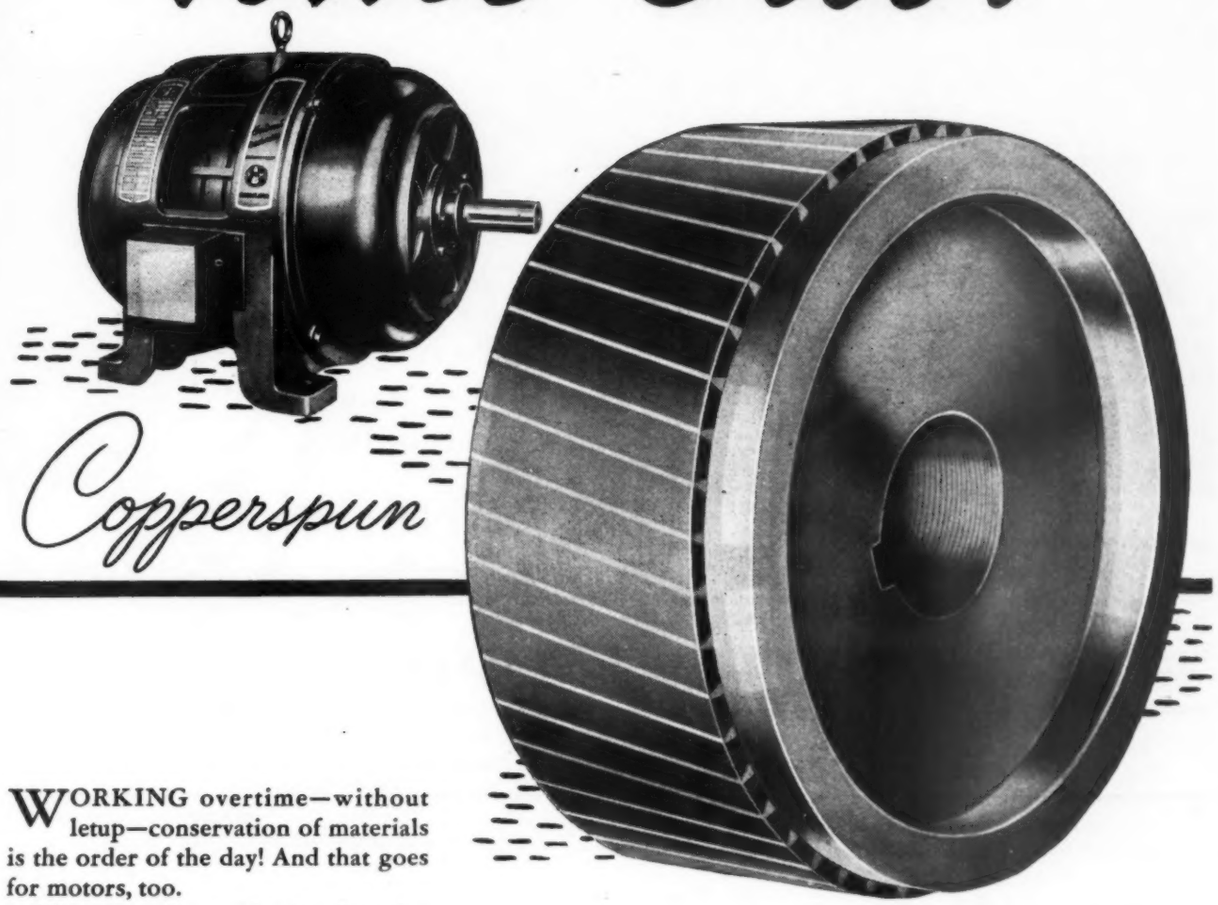
17. Has the advisability of inclosing elevator shafts and stairwells been considered? Heated air tends to escape up shaftways and wells, thus draining, and chilling, the lower floors.

18. Is it feasible to separate by partitions areas in which temperature differences are permissible or necessary?

19. Is it feasible to install doors in openings in partitions between areas in which temperature differences exist?

20. Are there openings in floors that can be closed either permanently or with trapdoors or otherwise?

There's *No Time* for *"Time Out!"*



Copperspun

WORKING overtime—without letup—conservation of materials is the order of the day! And that goes for motors, too.

Allowances for overload and service factors are out for the duration. Yet your motors have to stay in there and pitch . . . hour after hour, day after day. They have to keep on going . . . starting, stopping, and reversing . . . with no time for "time out."

Reason enough why you should use your priority to buy Fairbanks-Morse Motors! The *only* motors with rotor windings centrifugally cast of COPPER, they're precision built for years of service . . . no stoppage, no breakdowns, no letdowns—*now* or later!

Speed production with F-M motors now . . . and after the war. Ask for a demonstration. Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

FAIRBANKS-MORSE F M **MOTORS** *DIESELS SCALES PUMPS*

Characteristics of Woods

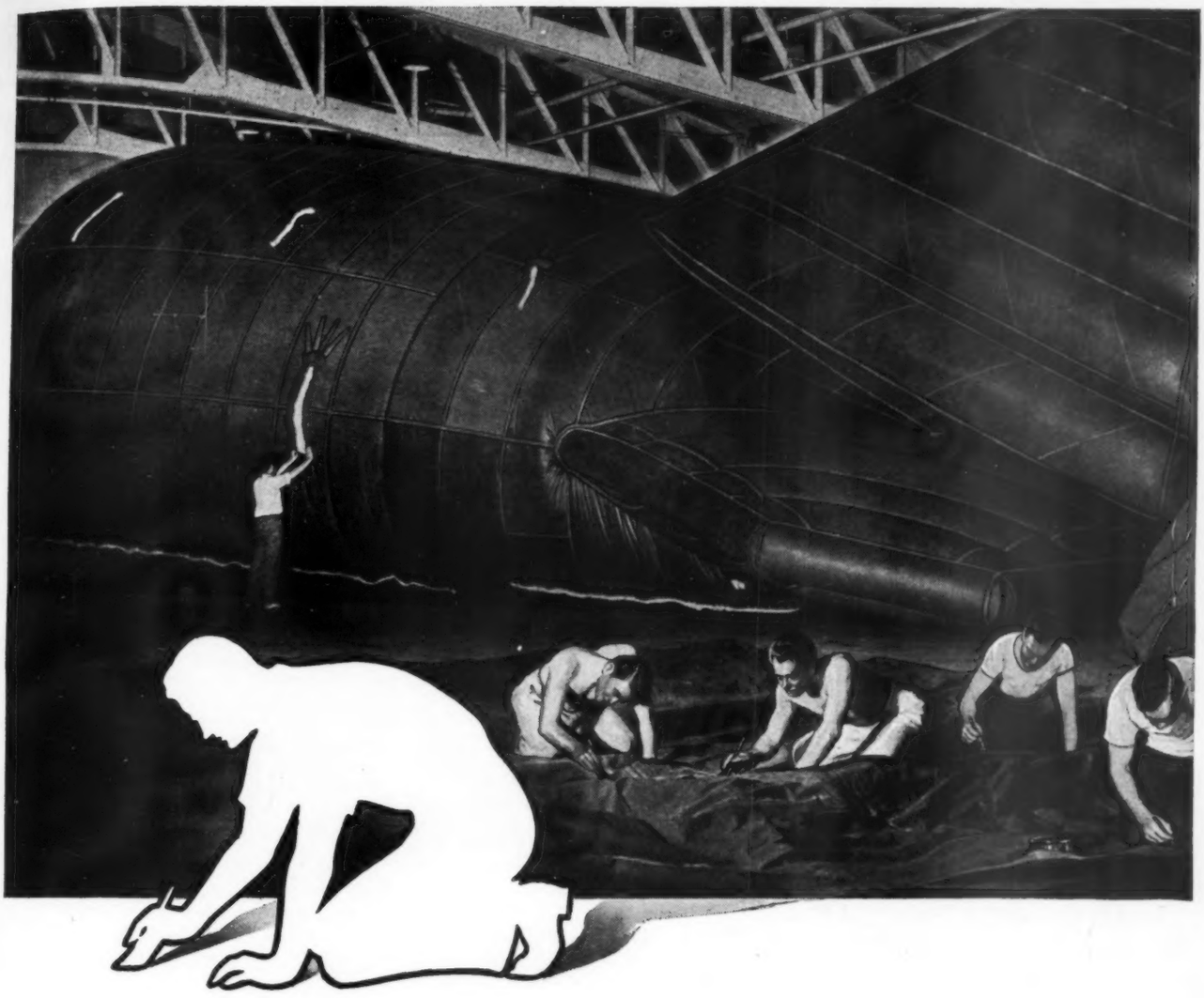
Characteristics of woods vary with the locality in which grown, moisture content, part of tree cut from, and general condition. Figures given here are averages for selected 2x2-in. specimens

	SOFT							HARD						
	Cedar, Red	Cypress	Fir, Douglas	Hemlock	Pine, White	Pine, Yellow	Spruce	Ash	Beech	Birch	Chestnut	Maple	Oak	Poplar, Yellow
Weight, pounds per square inch	22	30	32	28	27	42	28	40	44	44	30	37	44	27
Strength in compression, parallel to grain (elastic limit, pounds per square inch)	5390	5970	9260	7780	5070	9250	5470	5600	4870	7720	4120	5130	4610	4470
Strength in compression, perpendicular to grain (elastic limit, pounds per square inch)	700	910	1220	830	760	1670	620	1540	1340	1410	930	1280	1210	740
Strength in bending (elastic limit, pounds per square inch)	6100	8700	10600	8000	7000	11800	7400	10200	9000	12300	7100	9200	8600	8400
Strength on impact (inches drop of 50-lb. weight to cause breakage)	16	26	33	26	18	32	28	36	35	58	18	31	39	22
Strength in tension, perpendicular to grain (pounds per square inch to break)	180	280	330	170	340	420	380	880	890	890	470	660	780	570
Strength in shear, parallel to grain (pounds per square inch to break)	920	1080	1270	1170	1070	1640	1160	2110	1970	1880	1160	1970	1760	1170
Strength in nail-hold (pounds pull to draw 7-penny cement-coated nail 1¼ inch)	144	....	....	213	203	313	196	407	414	406	....	406	333	201
Hardness — side (pounds load to imbed 0.444-in. ball to one-half its diameter)	380	550	810	620	470	1020	510	1320	1190	1320	580	990	1310	450
Durability under conditions favorable to decay	Exlnt.	Exlnt.	Good	Poor	Good	Good	Poor	Fair	Poor	Poor	Exlnt.	Poor	Fair	Fair

Principal Uses in Plant Maintenance

	SOFT							HARD						
Uses	Cedar, Red	Cypress	Fir, Douglas	Hemlock	Pine, White	Pine, Yellow	Spruce	Ash	Beech	Birch	Chestnut	Maple	Oak	Poplar, Yellow
Fencing	X	X	X	X	X	X	X							X
Flooring		X	X	X		X			X	X		X	X	
Flooring-sub	X	X	X	X	X	X	X							
Framing		X	X	X	X	X	X							
Ladders					X		X							X
Millwork	X	X	X	X	X	X	X	X		X	X	X	X	X
Piling			X			X					X		X	
Poles	X	X	X		X	X					X		X	
Posts	X		X		X	X					X		X	
Shelving	X	X	X	X	X	X				X		X	X	
Structural		X	X	X		X			X				X	X
Tanks	X	X	X	X	X	X					X	X	X	X
Ties	X	X	X	X		X			X	X	X	X	X	X

The principal source of these data is the U.S. Forest Service



THE MISSING MAN

A million men are NOT working today because of illness

PICTURE all American industry stopped one week this year. You'd see, in a dramatic way, the enormous price we now pay for illness. And over half of this loss is due to the common cold and its complications.

These figures are based on reports of the U. S. Public Health Service and other reliable sources.

Absences were reduced in 92% of the companies which established health programs, it was shown in the Industrial Health Practices survey of the National Association of Manufacturers. Soap, hot water and individual tissue towels discourage the spread of illness.

Perhaps your workers now have the safeguard of ScotTissue Towels. In this case, enlist their help in preventing waste. Then more workers can enjoy the benefits of these towels.

Join the Scott WAR ON WASTE

The Scott Washroom Advisory Service has helped certain firms to cut waste of towels up to 30%. Through our posters and other means, employees are encouraged to use only *one* towel at a time.

Actually, one "Soft-Tuff" towel will absorb twice the water normally left on hands after washing. It has ten times the rub strength of previous ScotTissue Towels, though soft as ever.

Other washroom economies have also been effected in many cases.

For further information, write Scott Paper Co., Chester, Pa.

"SOFT-TUFF" Scot Tissue TOWELS

Stay Tough When Wet

Trade Marks "ScotTissue," "Soft-Tuff," "Washroom Advisory Service" Reg. U. S. Pat. Off.

TO blast the enemy out of the sky . . .

20,000 anti-aircraft guns in 1942 . . .

35,000 anti-aircraft guns in 1943 . . .

That is America's promise to the Victory Program—and America is going to beat that promise.

We are building a new America of huge new plants . . . enlarging facilities to insure ever-increasing production of weapons needed so urgently by our armed forces.

Behind this tremendous building program is steam. For steam serves America in war, as in peace. Steam, harnessed and brought under control with Webster Steam Heating Equipment, provides the heating comfort essential to all-out production.

Today, we are engaged in direct war work, but manufacturing facilities are still available to supply Webster Steam Heating Equipment for plants serving the war effort.

Essential repairs for Webster Systems are available on A-10 priority, under W. P. B. Emergency Repair Order P-84. Orders should be limited to actual needs.

Warren Webster & Company, Camden, N. J.
Representatives in 60 principal Cities

Webster
Steam Heating

YOU WANT TO KNOW

more about the items mentioned on this page

Letters to the addresses given will bring information

• CHEWING GUM helps workers feel better and work better by eliminating industrial lag in mid morning and mid afternoon says a booklet indicating results of actual tests in various plants and quoting excerpts of letters received from numerous manufacturers who distribute gum daily to employees. Wm. Wrigley Jr. Co., 410 North Michigan Ave., Chicago.

• MAJOR PROBLEMS encountered in effectively mobilizing a potential work force of 71,000,000 for war are summarized in "Problems of Labor Supply for War Production," a digest of facts and predictions compiled to aid employers formulate personnel policies in line with war production demands. Industrial Welfare Department, Zurich Insurance Companies, 135 South La Salle St., Chicago.

• GOVERNMENT PAMPHLET, "Explanation of Principles for Determination of Costs Under Government Contracts," outlines manufacturing and other contract performance items and expenses of an administrative and distributive nature allowable under contracts with Army, Navy, or Procurement Division of Treasury Department. 10c. Superintendent of Documents, Washington, D. C.

• NEWLY DEVELOPED projected wood window sash, treated to resist deterioration, is offered in 18 standard basic units, each unit an opening in itself. Frames are factory fitted and sash is prefitted to exact size to reduce installation expense. Projection permits interior screening or window shades. National Door Manufacturers Association, Inc., 332 South Michigan Ave., Chicago.

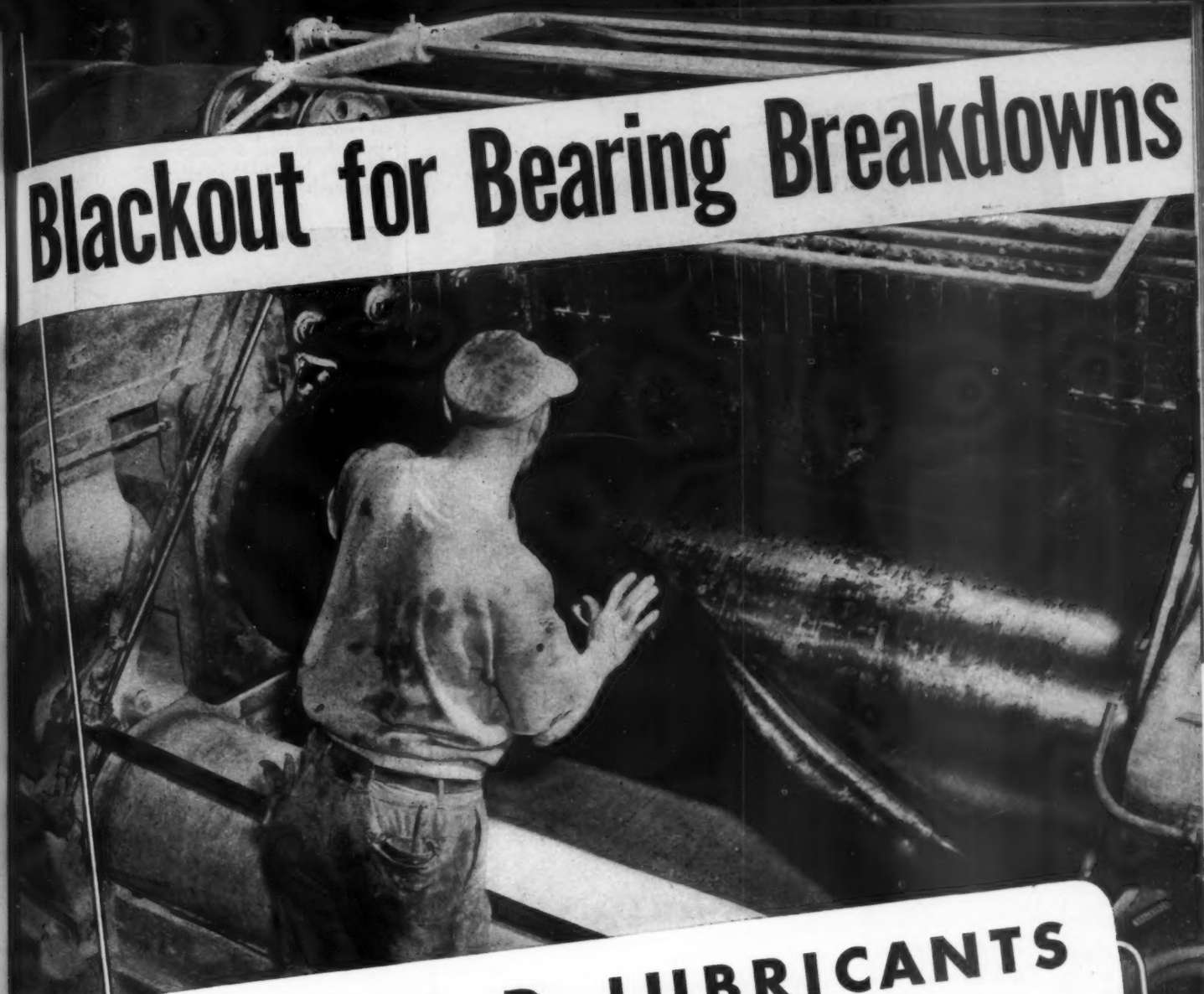
• WHEN WOMEN'S HANDS are exposed to oil, grease, solvents, or paints in war plants they are not likely to stay soft and white. Protective hand cream applied to hands, arms, and under the nails, before work starts, forms an invisible film that can be washed off with soap and running water at the end of the day. E. I. du Pont de Nemours & Co., Inc., 350 Fifth Ave., New York.

• TO AID in keeping energy, health, and morale of war production employees up to par, Nutritional Research Products, Inc., 307 West 8th St., Los Angeles, has put out a daily food ration in the form of two tablets. One contains minimum daily requirements of minerals and the other minimum daily requirements of vitamins as established by the Federal Food and Drug Administration.

• ONE WAY to cut down time spent, after a welding job, in removing spattered molten particles from the metal is to apply a creamy white liquid to the metal immediately or several hours before welding. Said to have no effect on the weld,

DESIGNED BY HOUSING ENGINEERS, this demountable barracks building is put up in 4-ft. panels. For less than $2000 (setting-up costs included), a 20x100-ft. building can be erected, it is said. Designed for industrial and military projects. The Travelodge Corp., 1120 Madison St., Lynchburg, Va.

Blackout for Bearing Breakdowns



SUN H. D. LUBRICANTS

Withstood 240° F.—250,000 lbs. pressure

Stopped Bearing Failure . . . Speeded Up Production

Bearing failures on mixers were a constant nightmare to engineers in a large rubber plant. Bronze bearings failed and ruined rolls . . . babbitt bearings wouldn't stay put . . . and production was the ultimate sufferer. Many types and grades of lubricants were tried without success.

Then the answer was found when the services of a Sun Engineer — one of those Doctors of Industry — was enlisted . . . a survey made . . . and the correct lubricant recommended. Since then there's been a "blackout" for bearing breakdowns and the "all clear" sign for production. Sun H. D. Lubricants stand up under the operating temperatures of 240° F. . . . total pressures of 250,000 pounds . . . and plant engineers say it looks as though bearings will last three or four years as compared to previous renewals of several times a year.

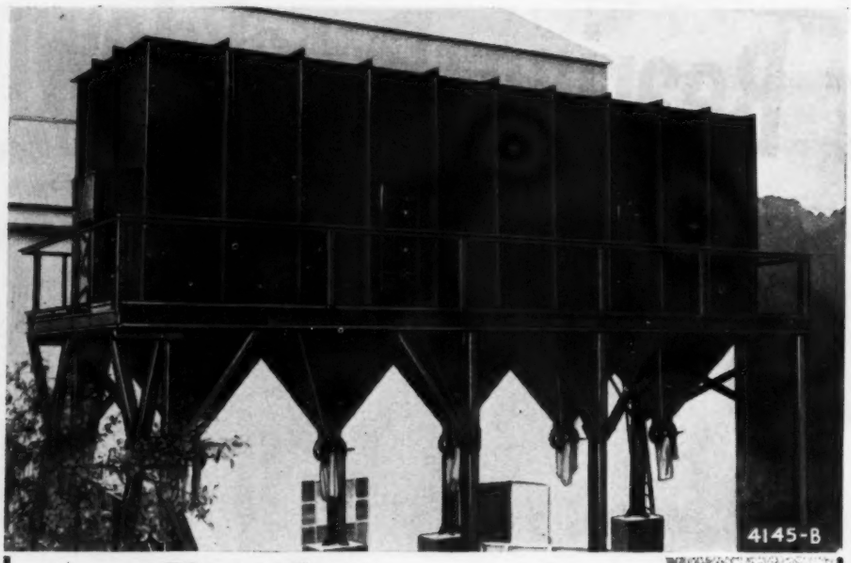
Whatever the problem you have involving petroleum products — lubrication or processing — call in one of those Sun Doctors of Industry. They have gained a reputation for helping industry win the battle of production and always stand ready . . . willing . . . and able to aid you in your plant. For proof of what has been accomplished in other plants write for your free copy of "Helping Industry Help America."

SUN OIL COMPANY—Philadelphia

Sponsors of the Sunoco News Voice of the Air—Lowell Thomas

SUNOCO

SUN PETROLEUM PRODUCTS.. HELPING INDUSTRY HELP AMERICA



SLY DUST CONTROL

IMPROVES WORKING CONDITIONS

UPS PRODUCTION

★ This Sly Dust Control System, for a large feldspar producer, collects dust caused by handling feldspar, particular in its crushing, screening, conveying, storage and loading.

Prior to the Sly installation, the dust presented a serious problem. The company consulted us. Definite air volumes were determined and the system installed accordingly—resulting in improved working conditions and increased production.

Sly Dust Filters offer certain exclusive advantages which help enormously in efficient operation:

(1) Greater filtering capacity because of more filtering cloth
(2) Taut bags (patented) save power and improve dust removal
(3) Bags more easily replaced
(4) Automatic control (any degree) minimizes or entirely removes the human factor
(5) Simpler shaker mechanism results in savings in maintenance and operation

Write us fully. We shall analyze your problems and tell you exactly what can be accomplished. Sly Dust Control pays for itself.

THE W. W. SLY MFG. CO.

4755 Train Avenue Cleveland, Ohio

SLY
INDUSTRIAL DUST CONTROL

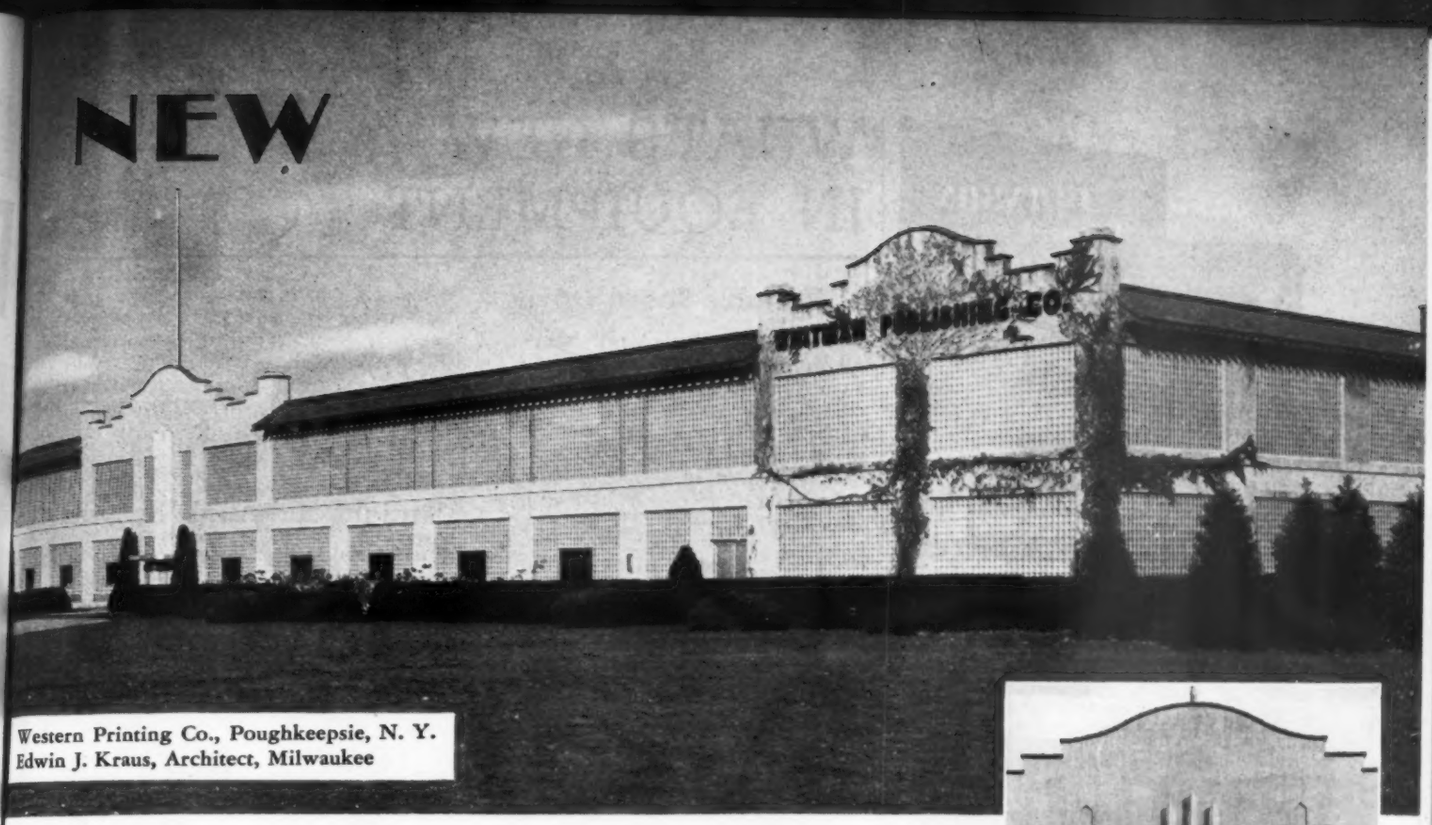
to be non-inflammable, and to give off no fumes. Can be used on steel, stainless steel, aluminum, or magnesium. Turco Products, Inc., 6135 South Central Ave., Los Angeles.

ADHESIVE QUALITIES of a water-clear liquid coating do not permit the sharp edges of this bulb to protrude through the protective layer it forms on the glass. A preventive for shattering, pitting, or scarring glass, it is recommended for window-pane applications in factories, and as a protection against weld-spatter and rain for unshielded electric bulbs. John C. Dolph Company, 170-D Emmet St., Newark, N. J.

• A LIGHT OIL, said to remove perspiration, water, oil, and dirt from steel is particularly valuable in dehydrating and cleaning steel surfaces, bearings, or similar parts which have become wet or have been left with a film of grinding emulsion. When applied, it displaces and absorbs water and leaves a thin film of lubricant and rust preventive. Soluble in hydrocarbon and lubricating oils. Chemical Development Laboratory, Curran Corp., six Pleasant St., Malden, Mass.

• SOUND MEASUREMENT test code for centrifugal and axial fans has been prepared by the Engineering Committee of National Association of Fan Manufacturers, 5-208 General Motors Building, Detroit, to provide a standard method of measuring sound of fans designed for air conditioning, heating, ventilating, and air handling problems. Form X-12. 10c.

• TANK-DIP PROCESS of preserving rubber is said to maintain elasticity and resilience of the rubber, fill pores and minor cuts; seal entire outside surface of the rubber against oil, grease, gas, air, and sun rays; halt oxidation. Applicable to all sorts of rubber articles, it is especially valuable in the preservation of tires, say the manufacturers. Transmotive Laboratories, 2250 South Michigan Avenue, Chicago.



Western Printing Co., Poughkeepsie, N. Y.
Edwin J. Kraus, Architect, Milwaukee

Old Plants Into *New*

with INSULUX *Glass Block*

Your plant maintenance program *need not* be halted by lack of materials. You can replace faulty windows with INSULUX Glass Block, using little or no metal—and have a *better lighted, better insulated* plant for efficient production now and after the war.

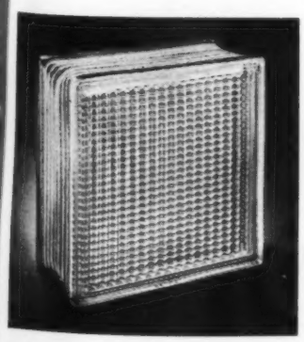
"The modernizing of Western Printing Company's Poughkeepsie plant with INSULUX Glass Block has been very successful," says Edwin J. Kraus, Architect, Milwaukee. "As in two other Western plants, built in 1937 and 1938, the glass block improved daylighting, gave more efficient control of interior conditions and will lower maintenance costs."

If your windows need replacing, INSULUX is the logical material to use. Panels are quickly installed, and wood sash or louvres can be set in for ventilation. Better insulation saves on heating and air-conditioning.

INSULUX is available for immediate delivery *at pre-war prices.* Mail coupon below for details of installing INSULUX panels without using metal.

INSULUX
GLASS BLOCK

- ...SERVE THE WAR EFFORT BY USING LITTLE OR NO METAL
- ...ARE FIREPROOF—NON-COMBUSTIBLE
- ...GIVE EFFICIENT DAY-LIGHTING
- ...HAVE HIGH INSULATION VALUE
- ...ARE AVAILABLE FOR IMMEDIATE DELIVERY AT PREWAR PRICES



OWENS-ILLINOIS
INSULUX
GLASS BLOCK

OWENS-ILLINOIS GLASS COMPANY,
INSULUX Products Division
Dept. 74, Ohio Bldg., Toledo, Ohio

Gentlemen: Please send, without obligation, your book on installation of INSULUX Glass Block with minimum use of metal.

Name_____

Address_____

City_____ State_____

Machine Finished

It's easy to avoid delay in securing plain bronze bearings. Specify JOHNSON *General Purpose* and your order will be shipped from stock. Every bearing is machine finished ready for assembly. Over 800 sizes to choose from . . . twenty two warehouse stocks to serve you. Write for new catalogue.

JOHNSON BRONZE CO.

Sleeve Bearing Headquarters

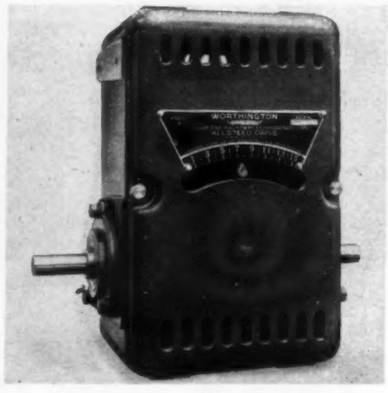
512 S. MILL ST., NEW CASTLE, PA.

Specify JOHNSON BRONZE

WHAT'S NEW IN EQUIPMENT

Variable-Speed Drive

Variable-speed multiple V-belt drive, called Allspeed Drive, is announced. Model A has a range of ⅓ to ¾ horsepower with a speed ratio of 16 to 1. This drive is said to be compact, ball-bearing equipped, and designed to operate in any plane. It can be directly coupled to any standard motor, and output shaft can be run at motor speed.



Mechanical, belt-tensioning device automatically compensates for increased arc of belt contact when changing from low to high speeds. Drive need not be dismantled to change belts. Worthington Pump & Machinery Corp., Harrison, N. J.

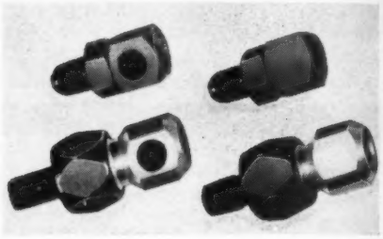
Communication System

Executive and monitor stations can talk to each other, or either can carry on two-way amplified voice conversations with remote desk or trumpet-type substations in outlying departments. Interceptor-control feature enables the assistant at the monitor station to intercept all incoming calls originating at the remote stations. Executive and monitor stations are equipped with busy signals; executive

station has the optional facility of right-of-way over busy stations for emergency use. Master station can call all other stations simultaneously for paging and issuing general announcements. High-powered trumpet-type substations provide extra sound volume to cover large space areas or penetrate high-noise levels. Pushbutton selection facilitates speed of operation. Electric connection is to 110-120 volts a.c. or d.c. current, power consumption is 46 watts. Executone, Inc., 415 Lexington Ave., New York.

Straight and Angle Swivels

Straight and 90-deg. angle swivels are for use in making oil, grease, air, and other line connections between stationary, revolving, oscillating, or other moving surfaces. Available in two different constructions.

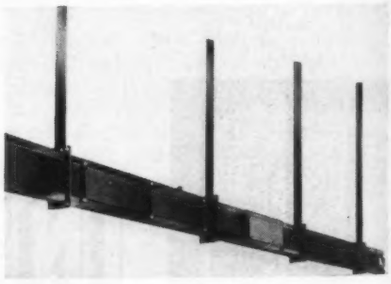


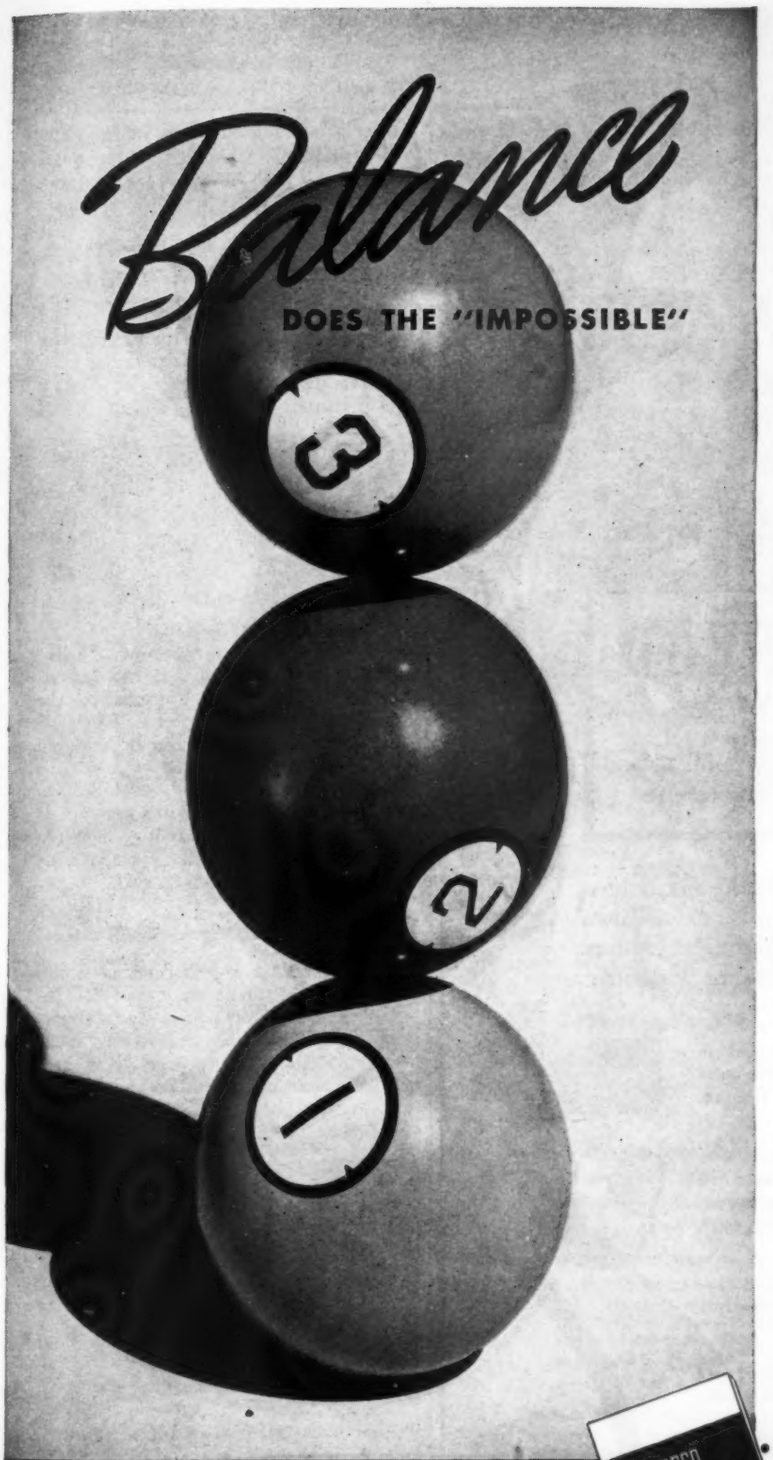
Standard ball-bearing swivels are available in ⅛, ¼, ⅜, ½, ¾ and 1-in. pipe sizes. Turn freely at any pressure without binding. Stem and nut on which balls turn are hardened to minimize wear. Light-duty swivels are built without balls and are offered only in ⅛ and ¼-in. pipe sizes. Both standard ball-bearing and light-duty swivels are furnished regularly with right-hand threads in both head and stem. Swivels with left-hand threads in either the head or stem, or in both the head and stem, and swivels built from special materials for handling corrosives, etc., can be furnished. Trabon Engineering Corp., 1814 E. 40th St., Cleveland.

Feeder Duct

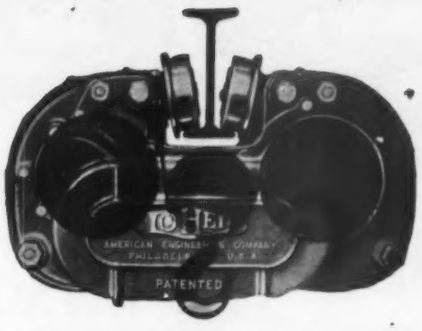
Saflex Feeder duct, known as a low reactance duct, is designed primarily to serve as feeder between transformer and main switchboards or to branch circuits where minimum voltage loss (1.8 volts per 100 feet) is essential. Duct is inclosed in non-critical, non-metallic insulation. Absence of inclosing steel eliminates iron losses and hum, the manufacturers state.

Split-bus arrangement provides electrical





AMERICAN ENGINEERING COMPANY

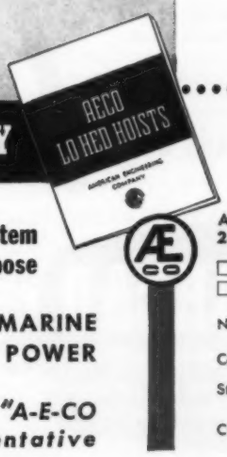


BALANCE did the "impossible" in this electric hoist

Until the invention of the Lo-hed electric hoist, drawing the hook block up close to the beam was considered impossible. See how the Lo-Hed hoist overcomes this problem. Motor and drum are on opposite sides of the supporting beam. This balanced arrangement allows the hook to be pulled up between motor and drum—until it almost touches the beam, giving you minimum headroom—a desirable plus feature for which you pay no premium. This same arrangement makes possible the use of an all spur gear drive from motor to drum.

Besides these benefits the Lo-Hed hoist has every desirable feature you want in an electric hoist . . . heavy duty hoist motor, ball or roller bearings, automatic holding brake, 100% positive automatic stop when load reaches its upper limit, gearing sealed in an oil bath, a controller proof against fire, dust and moisture, easily removable covers and many others.

The Lo-Hed hoist is built to stand up three shifts a day, 7 days a week—the kind of a hoist you need now. The Lo-Hed you buy today will be going strong long after the war has ended . . . and you want that kind of a hoist too. Send for our catalog today.



The Lo-Hed Hoist Is Applicable To Any Monorail System
There's A Balanced Lo-Hed Electric Hoist For Every Purpose

•

OTHER A-E-CO PRODUCTS: TAYLOR STOKERS, MARINE DECK AUXILIARIES, HELE-SHAW FLUID POWER

•

Look in your Classified Telephone Directory under "A-E-CO LO-HED HOISTS" for your nearest representative

AMERICAN ENGINEERING COMPANY
2426 Aramingo Avenue, Philadelphia, Penna.

☐ Please send me your complete catalog of LO-HED HOISTS
☐ Ask your representative to get in touch with me promptly

Name_____

Company_____

Street Address_____

City_____ State_____
(Please Print Plainly)

WEATHERHEAD
FITTINGS AND HOSE
Meet Vital Needs

★ On plane—on ship—on tank—on truck—on machine equipment—wherever power, fuel and oil lines must be kept functioning—Weatherhead fittings and hose meet vital demands of industry. ★

ERMETO SAFETY FITTINGS

For tubes of any metal. Hold up beyond the burst strength of the tube itself. Provide safe, strong, dependable tube joints. Easily connected and disconnected. No flaring, soldering, welding or threading required.

BRASS TUBE FITTINGS

A complete line of tube service parts made from extruded brass rod free from porosity. Inverted, S. A. E. and compression types with square finish that makes installation easy.

FLEXIBLE FUEL LINES

Oil-proof—gasoline-proof—vibration-proof. Supplied as complete assemblies or in lengths with wide variety of easily attached fittings.

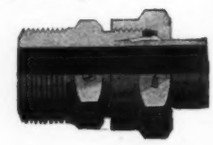
PACKLESS VALVES

Leak-proof; quick acting; sturdy; low overall height; natural grip hand wheel; full capacity openings; excellent for fuel lines.

★ ★ ★

Tell us the Weatherhead products in which you are interested and we'll send complete details.

THE WEATHERHEAD CO. • CLEVELAND, OHIO



WEATHERHEAD

TUBE FITTINGS • VALVES • DRAIN COCKS • AVIATION, AUTOMOTIVE AND REFRIGERATION SPECIALTIES

symmetry of the phases; low voltage drop is due to close spacing of buses, separated by only ¼ inch of insulation. In full-load tests duct has a 38-deg. centigrade temperature rise.

Duct is available in capacities from 500 to 6000 amperes, 600 volts or less for single phase, 2- and 3-phase, and 3-phase, 4-wire services. Switch & Panel Division, Square D Co., Detroit.

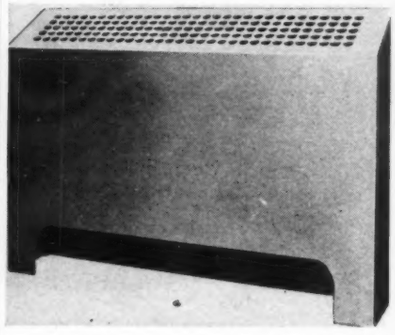
Transformer Cooling

A cooling unit, called Electro-Cooler, will step up capacity of transformers already in service by about 20-60 percent, the manufacturer reports. Electro-Cooler consists of a radiator-type cooler and a special

pump with motor inclosed. These are connected by piping to the standard radiator valves at the side of the transformer. No stuffing boxes are required in the special pump, and the motor is self-cooled and self-lubricated. Unit can be removed without draining transformer oil, and parts can be replaced with the transformer in operation. More than one is usually required, the number depending upon the size of the transformer. Allis-Chalmers Mfg. Co., Milwaukee.

Non-Metallic Cabinets

Cabinet convector is constructed entirely of non-metallic materials except for the screws. Side and top panels are fabricated from rigid fiberboard. Supporting members provided at the corners are of hard wood. Element of the non-metallic cabinet



convectors is constructed of steel fins and tubes, and uses one-fifth of metal in ordinary radiators, it is claimed. Wall-suspension and floor-type cabinets are available. Circular grilles are punched in the sloping tops of both types. The Trane Co., La Crosse, Wis.

Sanitation Material

Deodorant No. 1 performs the triple function of cleaning, deodorizing and disinfecting all in one operation. It is especially useful in maintaining clean washrooms. Odorless itself, it does not mask one odor with another. Solutions are

POP'S ON THE WAR-PATH AGAINST WAR-WORK WASTE

THERE GOES A BLISTERING FOR SOMEBUDDY! ... POP'S DISKIVVERED A SWELL NICHOLSON SHEAR TOOTH FILE PUFFECTLY RUINED ON A FOUNDRY CASTING JOB..
THAT'S THE SECOND WAR DANCE THE OL' MAN'S PUT ON TUHDAY. THIS AYAM HE CAUGHT JO GLUB SCUFFIN' THE DAYLIGHTS OUT OF THE TEETH OF A BRAND-NEW NICHOLSON BY RAMMIN' IT INTO A KIT OF TOOLS LIKE HE WAS HEAVIN' SCRAP IRON ...
POP HAS ABOUT AS MUCH RESPECK FER A DRIP WHO'S CARELESS WITH TOOLS AS A SKUNK HAS FOR HUMAN DIGNITY!

LET'S GO! U.S.A. · KEEP 'EM FLYING!

INDUSTRIAL man-hours were never so precious — maximum production was never more urgent than now.

Tools are still one of the most troublesome "bottlenecks." There is still too much waste of tool life through *improper use, improper care* and *improper selection.*

No tools are more exposed to these life-shortening abuses than files — especially in the hands of today's many new and partly trained workers.

Shop superintendents and foremen can save valuable time, improve efficiency, reduce rejects and material wastage, through an educational drive on *the right use of files — the right care of files* — and *The right file for the job.*

Nicholson and your mill-supply house can help you on all three counts. Nicholson is more than a manufacturer of files for every purpose (over 3000 kinds, cuts and sizes). Nicholson is an authority to whom you can bring your filing problems freely.

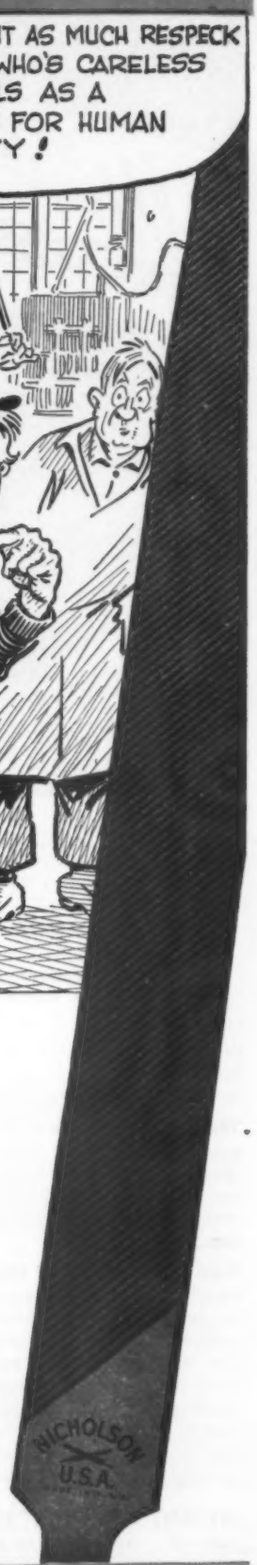
FREE LITERATURE on fundamentals of filing.

FREE TECHNICAL BULLETINS on special files for Stainless Steel, Aluminum, Brass, Plastics, Die Castings, Foundry Castings, Die Making; Shear Tooth, Lathe filing. Name ones wanted.

FREE WALL CHART on regular file shapes, sizes and cut coarsenesses.

SHEAR TOOTH FILE *(right)* — one of the Nicholson or Black Diamond "specialists." For rapid soft-metal removal *plus* smooth finishing. The combination of coarse single cut and long angle helps the Shear Tooth to clear itself of chips—minimizes clogging. Coarseness provides fast cutting; long angle gives shearing or "shaving" cut. Flat, Square, Half Round — all sizes — through your mill-supply house.

NICHOLSON FILE CO., PROVIDENCE, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)



TWELVE PERFECT FILES IN EVERY DOZEN

NICHOLSON FILES
FOR EVERY PURPOSE

NICHOLSON U.S.A. MADE IN U. S. A.

★ In one of their recent bulletins on hoists, the National Safety Council says:

> ❝ *Hooks which have become bent on account of overloading should not be straightened and put back in service, but a new hook should be provided. When a hook is once bent the stress in the metal tends to weaken it so that afterward its strength is a matter of doubt and cannot be depended upon.* ❞

That's good advice. With the lives of American boys utterly dependent upon our industrial production, this is no time to take chances which may cause lost time accidents to men or machines, or both.

Watch the Hooks. Wright load hooks are drop-forged from special steel which, when subjected to excessive overloading, give visible warning by opening slowly. When the bottom hook has started to open, look to the top hook, too, for while it is stronger than the bottom hook, it also may be reaching a danger point.

Don't Abuse Your Hoist. Now that we are all faced with restrictions and shortages proper maintenance is of paramount importance. While every **WRIGHT HOIST** is built with load-carrying factors considerably in excess of their rated capacities, like many other well-made pieces of mechanical equipment built for specific duty, they should not be overloaded. Overloading is dangerous—to men, materials, machinery and steady production. Remember—abuse to machinery today is akin to sabotage. Conserve steel and maintain production schedules by careful use, regular inspection and proper lubrication.

WRIGHT MANUFACTURING DIVISION
YORK, PA. CHICAGO SAN FRANCISCO NEW YORK

In Business for Your Safety

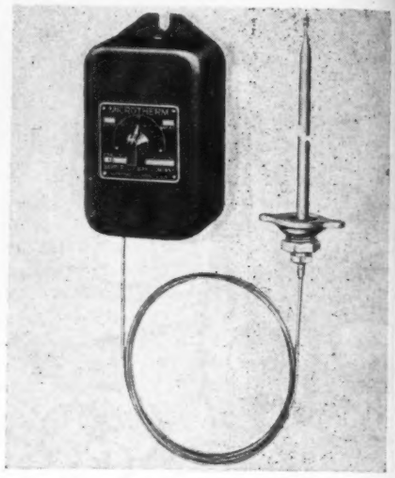
TRADE MARK ACCO

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT

easily prepared—small amounts are dissolved in cold water, the solution to be applied to surfaces with mop, sponge, brush, or cloth. Dissipates a wide range of offensive odors in a short period, and removes dirt, oil, grease and grime from cement, tile, porcelain, metal, and wood surfaces, it is claimed. Packed in 375 and 125-lb. drums and 45-lb. pails. Oakite Products, Inc., 14A Thames St., New York.

Thermostat

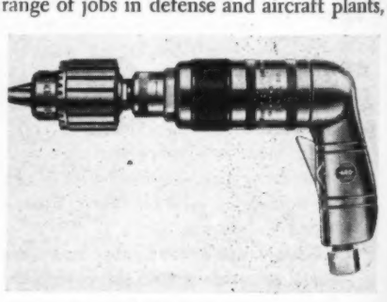
Thermostat, known as Remote Bulb Microtherm, is liquid filled, for use when it is desirable to mount the mechanism where it is readily accessible, free from vibration, dust, dirt, and extreme tempera-



tures. Thermostats are available with or without armored tubing, and control temperatures in ducts, tanks, liquid lines, dryers, cooking kettles, and similar applications. Barber-Colman Co., Rockford, Ill.

Pneumatic Drill

Rotary air drills, straight and right angle, of $\frac{3}{8}$-in. capacity, are suitable for a wide range of jobs in defense and aircraft plants,



shipyards, and other industrial plants, it is claimed. The Aro Equipment Corp., Bryan, Ohio.

Three-In-One Meter

Instrument, designated as Model No. 662, is an electronic voltmeter, ohmmeter, and capacity meter in one. Furnishes accurate and comprehensive capacity readings directly in microfarads, with a measurement ratio of 40,000,000 to 1, according to manufacturers. There are no test leads to short, and no resetting is necessary when

LET'S GET DOWN TO DETAILS

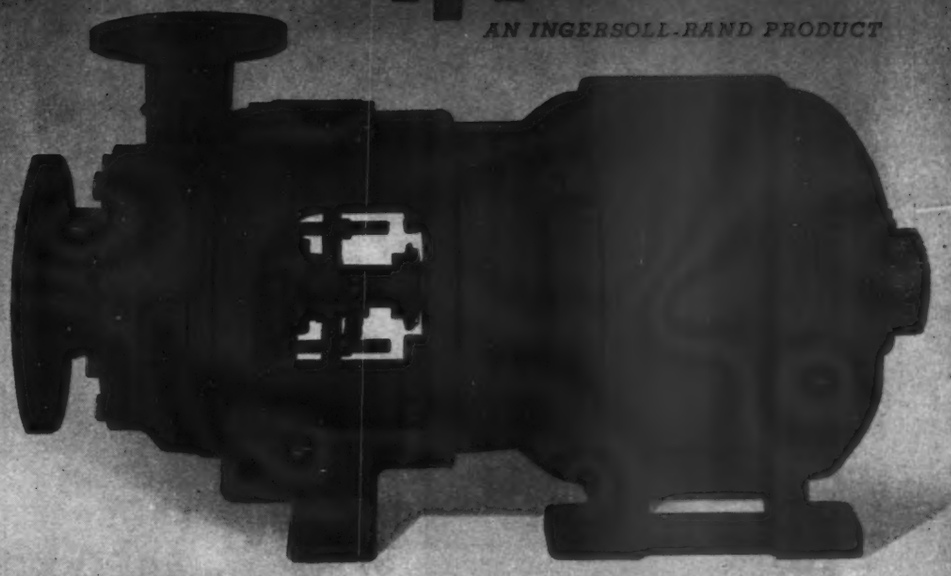
THE CAMERON

MOTORPUMP

AN INGERSOLL-RAND PRODUCT

Design and construction details in a pump are of the utmost importance. Upon them depend pump efficiency, length of service, freedom from trouble and ease of maintenance.

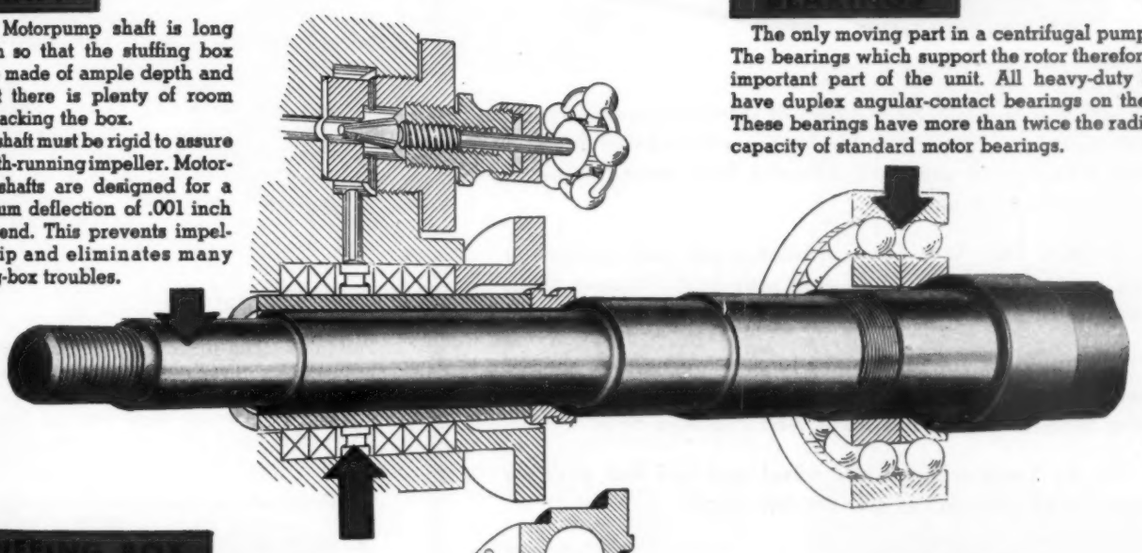
Careful attention to details has in a large measure been responsible for the outstanding success of the Ingersoll-Rand Motorpump. Some of these details are show below. Let our engineers discuss the Motorpump with you. Capacities 5 to 1800 gpm; heads to 500 feet.



SHAFT

The Motorpump shaft is long enough so that the stuffing box can be made of ample depth and so that there is plenty of room for repacking the box.

The shaft must be rigid to assure a smooth-running impeller. Motorpump shafts are designed for a maximum deflection of .001 inch at the end. This prevents impeller whip and eliminates many stuffing-box troubles.



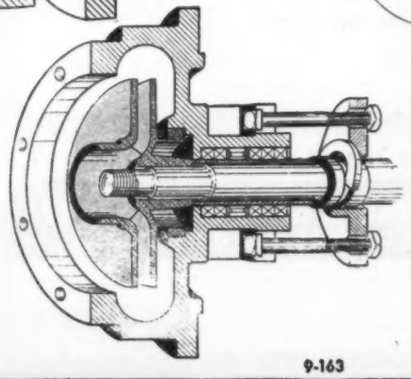
BEARINGS

The only moving part in a centrifugal pump is the rotor. The bearings which support the rotor therefore, are a most important part of the unit. All heavy-duty Motorpumps have duplex angular-contact bearings on the pump end. These bearings have more than twice the radial and thrust capacity of standard motor bearings.

STUFFING BOX

The stuffing box on the Motorpump holds sufficient packing to permit accurate control of the sealing action. In addition a sealing gland is placed in the box, except for liquids requiring special packing. When the pump handles water the liquid for this gland is taken from the casing. Its flow is controlled by a needle valve. External seals are provided when handling liquids which can not be used in the sealing gland.

There is ample room to repack the stuffing box, and a convenient split gland is provided.



IMPELLER PULLER

In order to facilitate the removal of the impeller, and shaft sleeve, a patented impeller puller is incorporated on heavy-duty Motorpumps.

This consists of a slotted sleeve on the shaft in which a yoke may be inserted. When the suction nozzle and impeller nut are removed, the impeller can easily be pushed off by tightening the stuffing-box gland against this yoke.

9-163

Atlanta Birmingham Boston Buffalo Butte
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Detroit Duluth El Paso Hartford Houston
Kansas City Knoxville Los Angeles Newark New Orleans New York
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If you are faced with the problem of increasing production in your grinding or finishing department, you'll find that Segment Face Wheels used with 3-M Abrasive Belts prove the means of securing added output.

Segment Face Wheels are available with soft, medium or hard surface faces and when used with 3-M Abrasive Belts, prove a faster grinding, finishing or polishing agent.

It will surprise you to learn the large number of odd shaped parts that can be finished to perfection with a Backstand Idler using Segment Face Wheels and 3-M Abrasive Belts.

It's the combination of the wheel and belt that does the trick. It will pay you to send for full details.

SEND FOR THIS BOOKLET THAT GIVES COMPLETE DETAILS

FM&M1042

MINNESOTA MINING & MFG. COMPANY
SAINT PAUL, MINNESOTA

MFRS. OF 3-M PRODUCTS 3-M Abrasive Paper and Cloth Products — "Scotch" Tapes and Grinding Compound — 3-M Cutting and Finishing Compound — 3-M Roofing Granules

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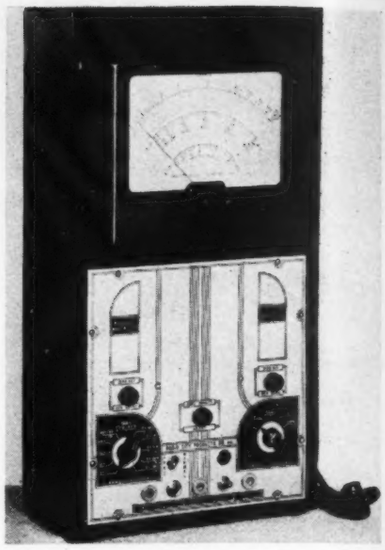


changing ranges. Meter cannot be damaged by checking a live resistor or by using a low range on high readings. Error due to line voltage fluctuation is eliminated by a VR105-30 regulator tube and associated circuits.

Model 662 employs a sloping panel and 4½-in. meter. Upright companion model (No. 662-V-7) has a large 8½-in. rectangular meter. Radio City Products Co., Inc., 127 West 26th St., New York.

Insulating Varnish

Flame-resistant insulating varnish, designated as R-878, is recommended by its manufacturers for Class B high-temperature insulation.

Varnish is mechanically strong and dries all the way through when applied to electrical apparatus. After drying will not support combustion when the flame is removed, neither will it melt nor resoften under operating temperatures. Sterling Varnish Co., 130 Ohio River Blvd., Haysville, Pa.

Wood Partitions

Partitions called Prefab-Plywood are made in two types. Type P is the flush style and uses metal only for the hardware—hinges, latches, handles and floor fittings. Type PS is the panel style with metal posts and headrail. On this type the plywood

YOU'D never know from the outside. The skin is firm, the color good. But on the viewing screen of an X-ray unit—an electronic device with a multitude of uses—appears a mottled image. Presto! The inspector discards the substandard fruit.

And other G-E electronic devices today are saving time and material, reducing production cost in war work . . .

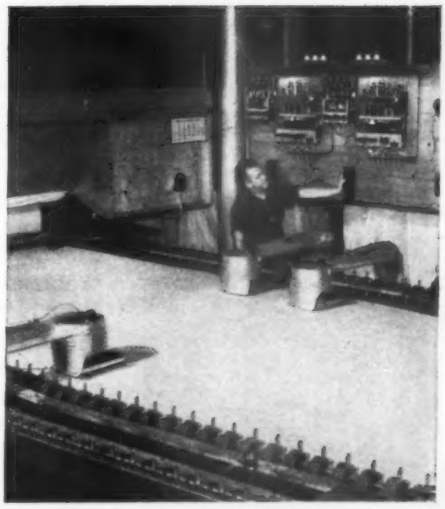
In aircraft factories, G-E electronic welding control reduces fabrication time of some parts—often by more than 50%.

Machine tools equipped with G.E.'s new, electronic motor control—Thy-mo-trol—now maintain their maximum production speed automatically. You get d-c speed flexibility *from a-c lines;* eliminate time-consuming or bulky speed-changing devices; conserve vital materials.

In rolling mills, steel strip is electronically inspected for pinholes as small as 1/100 inch in diameter *at 750 feet per minute.*

There is scarcely an industrial plant where a G-E electronic device cannot in some way bring about faster, more economical production.

A 20-page booklet, "G-E Electronic Devices for Industry" (GES-2411), will give you further information. Contact any G-E office or write to General Electric, Section C 645-20, Schenectady, New York.



Electronic inspectors do hundreds of jobs. Here G-E electric eyes scan the speeding cross-threads in a cloth tenter, detect skew in the cloth, and signal the driving motors to correct the difficulty. This "photo-squared" cloth irons flat, hangs evenly.

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment

GENERAL ELECTRIC
LEADERSHIP IN ELECTRONICS

A NEW SCIENCE GOES TO WORK FOR INDUSTRY

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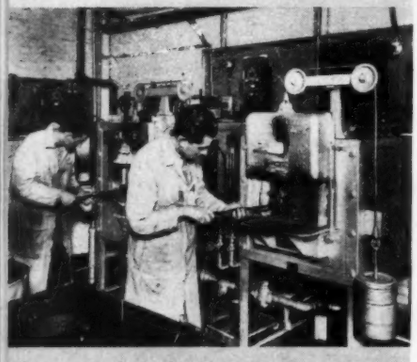
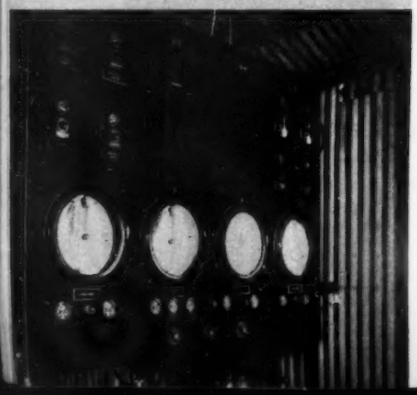
GREEN HANDS

can "upgrade" faster!

Foxboro Potentiometer Controllers on Furnaces enable new-trained men to produce uniformly accurate results.



Even complex jobs like pipe-line pumping station control are automatically performed by Foxboro Instrumentation.



REMOVE the need for guesswork in your production operations... and you've gone a long way toward solution of your man-power problems. For, even "green hands" can then learn new jobs quickly and accurately!

A tall order? *Not by any means!* Install Measurement and Control Instruments by Foxboro and the uncertainties are eliminated ..."skilled" operations become simple routine.

Through Foxboro Instrumentation, measurements of important temperatures, pressures and flow-rates give operators positive guidance at all times. Continuous records show what happened throughout each run. And, in many instances, fully automatic control gives results more accurate than *any* manual control!

Your upgrading problems, too, may be open to important simplification through use of appropriate Foxboro installations. Why not find out? The Foxboro Company, 24 Neponset Avenue, Foxboro, Massachusetts, U. S. A.

FOXBORO

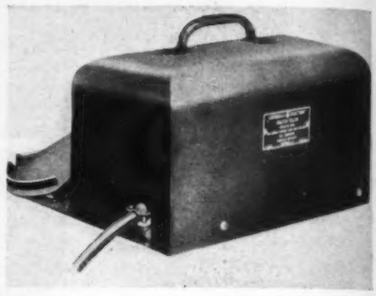
Reg. U.S. Pat. Off.

MEASUREMENT AND CONTROL SYSTEMS

panels can be replaced with Ferrometal panels when these are again available. Supplied complete with all fittings, finished in grey or white enamel, these partitions save time in installation. They are delivered all ready to be bolted into place. Milwaukee Stamping Co., 809-P South 72nd St., Milwaukee.

Crater Filler

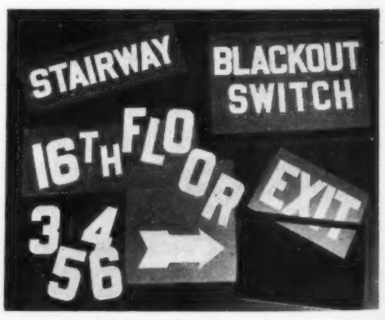
The crater filler, a foot accelerator for welders, is designed to provide close auxiliary control of heat required in welding thin material, such as aircraft tubing, and to permit tapering off of welding current at the end of a bead. Crater filler



is essentially a combination of a foot-operated rheostat for reducing the current and a field forcing switch for providing a hot start or an increase in welding current when required. Not intended to replace the function of usual control, it is used to increase or decrease the heat setting to accommodate abnormal conditions at the beginning or end of a weld, or during a weld. General Electric Co., Schenectady, N. Y.

Luminous Letters

Blackout signs remain luminous for approximately six hours, and are self-charging when in contact with daylight or artificial light from an ordinary bulb, it is claimed. In daytime the signs appear as conventional directives, while at night they glow strikingly, showing the color bluish-green. Function on all occasions without need



for replacement. For those who prefer to make their own signs, three sizes of luminous letters, figures, and symbols, gummed on the back, are available, and background cards can also be supplied. Sizes of letters are 2, 3¾, and 4 inches and come in block style. Luminous signs are also made to order from copy furnished and are mounted on red background cards, with a choice of card sizes. Card sizes are 10x6, 12x10, 18x7, and 18x11 inches. If

today's armed forces roll on rubber. But the chief source of supply has been cut off by the hazards of war.

This has made the manufacture of rubber products in sufficient quantity for the war effort a task of exceptional magnitude and difficulty.

That task is being surmounted. Rubber is going where it will fight most effectively for the common good.

Our production, large as it is, is now directly or indirectly requisitioned for war needs. We are cooperating with the Government in every way to insure victory as soon as possible.

BOSTON WOVEN HOSE & RUBBER CO.

CAMBRIDGE, MASS.

"Hold that line!"..with R/M PACKINGS

Steam lines, oil lines, air lines, fuel lines . . . all must operate under higher pressures today as production calls for speed and more speed. R/M packings are made to Hold That Line, up to the limit beyond which no machine or material can be pushed.

R/M engineers are constantly testing and re-testing to prove and improve, so that R/M packings *can* take it, *can* meet the stepped-up strains and stresses of production for all-out war. R/M means Raybestos-Manhattan. R/M means Reliable Materials.

Do you have a copy of the R/M catalog? It's keyed for applications, illustrated, and indexed as to materials and types. Get a copy of this catalog from your R/M distributor, or write us direct.

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Makers of Packings for Every Industrial Use

desired, wood frames will be furnished. The Tablet & Ticket Co., 1021 W. Adams St., Chicago.

Loose Pulley Oiler

A wick type lubricator oils loose pulleys, idler pulleys, clutches, eccentrics, and similar rotating machine parts. It delivers a constant, positive, and regulated amount of filtered oil to shaft or bearing while

pulley is in operation, and prevents oil waste when pulley is idle. The reserve supply of oil is always visible.

Oil-Rite loose pulley lubricator consists of a simple glass oil reservoir, mounted on a hollow metal stem. Stem is sealed from the oil in the reservoir, except for two small ports at the top. In side the stem is a cylindrical felt wick, which extends through the pulley hub to rest directly on the shaft. A compression spring holds the wick in position against the shaft.

As the pulley rotates, and the lubricator with it, centrifugal force throws the oil against the top of the reservoir, and into the two ports in the stem. These admit oil to the wick, which conducts the oil directly to the face of the shaft, it is claimed.

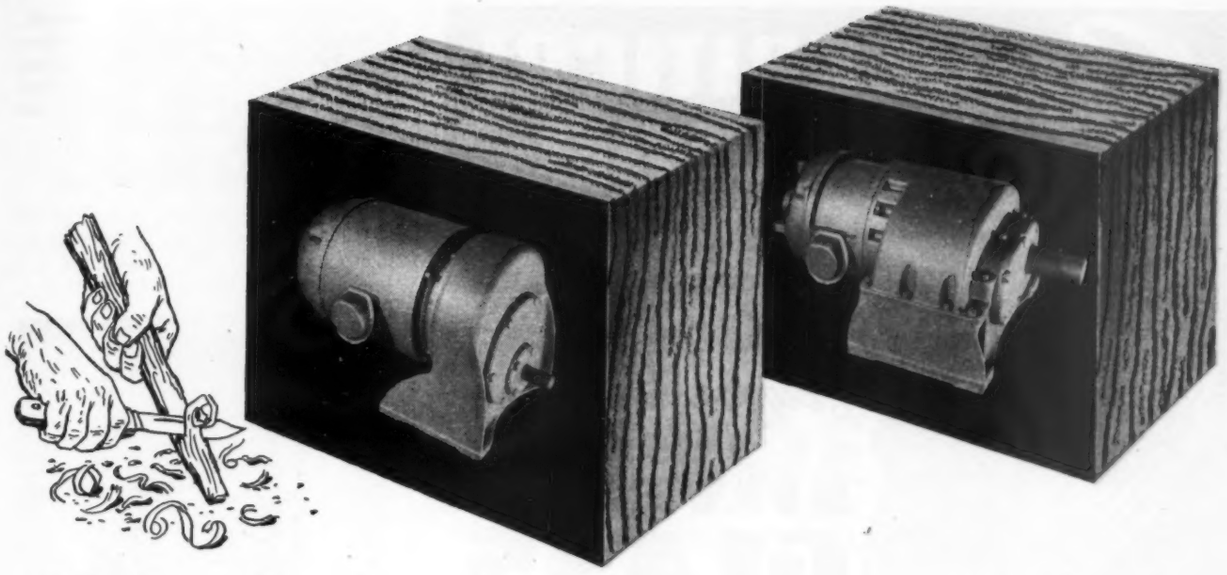
Oil delivered is regulated by means of a small plug which controls the area of the oil ports. Five standard sizes are available—capacities from ¼ to 2½ ounces. Oil-Rite Corp., 3466 S. 13th St., Milwaukee.

Waterproofing Powder

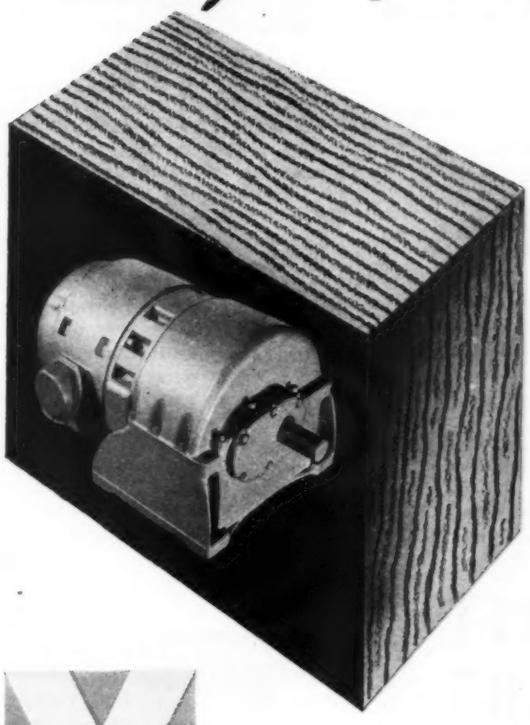
Chemical powder, called Drye, is said to waterproof brick, stone, stucco, and mortar joints. Can be used for hardening and waterproofing cement and mortar when included in the mix, and is suitable for patching cement floors and bonding tile to cement. Also will repair cracks in iron and can be used as a furnace cement.

Easily mixed with cold water to form a paste that can be brushed or troweled on the walls or surface to be waterproofed. One application is required for outside work; two coatings if applied inside. Coverage is said to be approximately 10 square feet per pound.

If colorless waterproofing is desired, a



Whittling improved gearmotor design *out of wood*



Westinghouse makes two kinds of gearmotors these days . . . some of metal and others of wood.

The metal gearmotors go to fill your present orders, to furnish power for the war production drive. Wood gearmotor models reflect the shape of things to come, the improvements and refinements you can expect in the Westinghouse gearmotors you will buy in the immediate tomorrow.

And here's what you can expect when these wood models change to steel:

LOOK for a streamlined appearance that has practical advantages; an improved design that is more efficient, easier to install.

LOOK for a more adaptable construction that fits snugly against the machine it is driving and requires a minimum amount of space.

LOOK for improved application practices which match the gearmotor to the job to be done.

LOOK for simplified gearmotor design, conserving critical materials yet retaining ruggedness of construction.

Westinghouse has the distinct advantage of designing, testing and building gearmotors as complete units. You have the assurance of knowing just how the motor and gear will perform *as a unit*. Ask your Westinghouse representative for recommendations on your slow-speed drive problems. Or write Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N. J-07202

GEARED FOR VICTORY

WESTINGHOUSE

Westinghouse

GEARMOTORS

Save CRITICAL WAR MATERIALS

for Better Lighting ..Bigger Production

USE SILVERED GLASS

Step up your lighting to step up production. Install PERMAFLECTORS, the highly-efficient, silvered-glass reflector that picks up the maximum flux of light and puts it exactly where you need and want it! Over 70 designs; a correct shape for any and every purpose — providing engineered light control, for concentrated, intermediate and broad light distribution. Write for literature.

FOR GENERAL INDUSTRIAL AND HIGH BAY LIGHTING

In new and remodelled plants, highly efficient general and localized lighting can be quickly, inexpensively secured with surface-mounted or suspended PERMAFLECTORS. Complete. Ready to install. Employ minimum critical war materials. Government-specified and Government-approved.

PICK UP THE WEAK SPOTS in your plant or production-line lighting with special Permaflector "auxiliaries." Decrease spoilage, reduce accidents, increase production.

New 500-WATT FLOODLIGHT

Ideal for all outdoor floodlighting applications. New 500-Watt floodlight is equipped with high-efficiency, silvered-glass PERMAFLECTOR, in any of 3 light distributions – broad, intermediate, concentrated. Rugged. Weatherproof. Rust-resistant. Complete. Ready to install.

PITTSBURGH REFLECTOR CO.

Pittsburgh Permaflector

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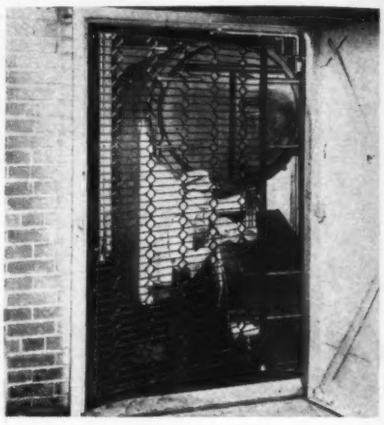
Tear Off

Clip to letterhead. Sign. Mail for complete information, prices.

companion product, Liquidrye is available. This product is scarcely visible where applied and is designed especially for porous types of masonry such as stucco. Liquidrye requires two applications. Weather Seal Co., 18 E. Pearl St., Cincinnati.

Grille for Doorways

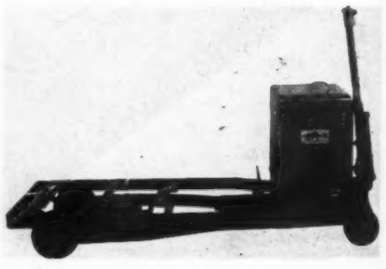
Swinging type grille offers device for barricading doorways without obstructing air, light, or vision. Grille is assembled in a heavy steel frame, equipped with steel en-



cased cylinder lock, permanently installed by massive side hinges, and offers barricading strength. Assembly of steel links and $\frac{1}{16}$-in. steel rounds affords neat appearance as well as strength. Apertures prevent admittance of a man's hand. It is furnished in any size. The Kinnear Mfg. Co., Columbus, Ohio.

Hand and Power Truck

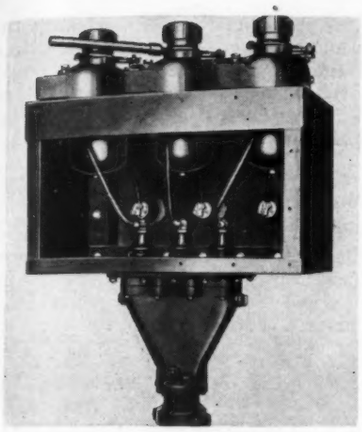
Electric-driven, hand lift truck known as PowerOx operates as a typical hand lift truck and then transports load by power. The truck weighs approximately 1080 pounds, will operate 8-12 hours without recharging and is heavily constructed. Load



capacity is 4000 pounds. It is made in 7, 9, and 11-in. heights, 19 and 25-in. widths, and 48 and 60-in. lengths. Multiple stroke lift is 3 inches. Truck is provided with a motor on each rear wheel, runs both directions at only one speed, and controller works in any position. Barrett-Cravens Co., 3255 W. 30th St., Chicago.

Oil-Fuse Cutouts

Metal-inclosed assembly of gang-operated oil-fuse cutouts permit totally metal-inclosed installations, either single- or three-phase. They save installation labor because each unit is factory-assembled with flexible, insulated cable leads ready for connection



to either single- or multi-conductor cable. The leads enter the individual cutouts above the oil level, thus preventing loss of oil. Switching requires merely throwing a lever 90 degrees. Fuse carriers can be removed without disturbing the gang-operating mechanism.

Adapted for use indoors or outdoors, the assemblies can be supplied for wall or direct-to-apparatus mounting, with openings for conduit, cable, or pothead connections. Voltages to 7500. General Electric Co., Schenectady, N. Y.

Non-Adhesive Films

Non-adhesive Tygon formulations provide easily removed temporary protection against rust, corrosion, grease, finger markings, dust and scratches to highly polished surfaces. Tygon Temprotec in clear or transparent colors for identification purposes, is applied by brush, dip, spray, or roller coating. It air dries within a few minutes at normal room temperatures to form a sturdy, durable, elastic film that will not become brittle under sunlight, and is unaffected by active oxidizing agents, water, alcohol or brine solutions. It is said to strip free, peeling off as a complete film without danger of injury to the surface beneath. Provides protection for surfaces of machine parts, tools, bearing surfaces, etc., during handling, shipping, and installation. The United States Stoneware Co., Akron.

Carbon-Dioxide Engine

Alfite, carbon-dioxide, 100-lb. engine is approved by Underwriters' and Associated Factory Mutual Laboratories for use on both electrical and oil fires. It is equipped with a horn to protect the operator from static charge. Designed for perfect balance at wheeling height, with swivel wheel for

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ROEBLING has on hand a limited quantity of Electric Wires and Cables of various insulations and constructions, which have been slow-moving under present market conditions. These wires are being shipped immediately on receipt of orders to those customers with proper priority ratings who are ready to accept slight changes in specifications. Some, for example, accept a conductor with greater flexibility than required. Others, a slightly heavier insulation which means slightly larger outside diameter. In every case, the wire or cable is of standard quality and offered as entirely satisfactory for the service.

Acceptance of alternates by the purchaser has enabled us to fill many emergency orders promptly.

Perhaps we can do likewise for you.

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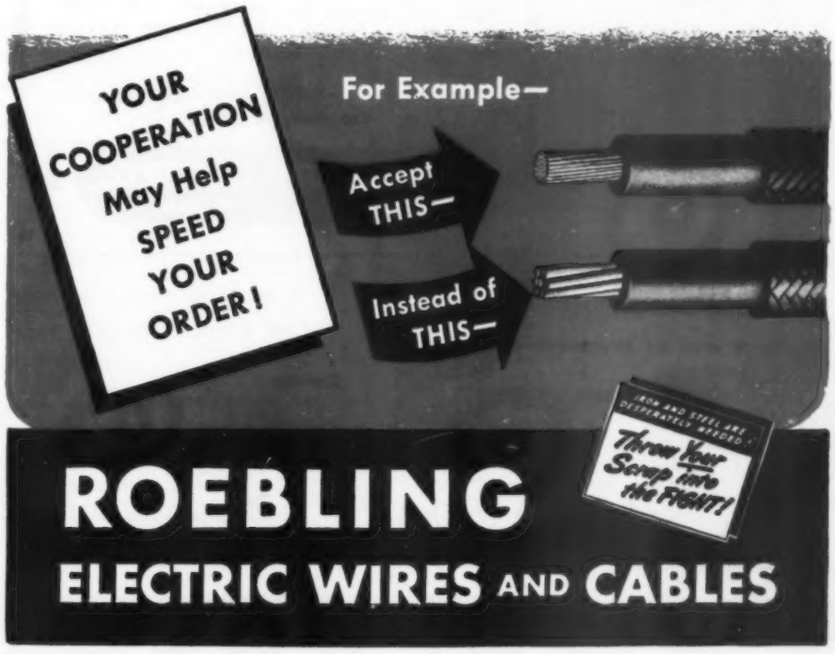

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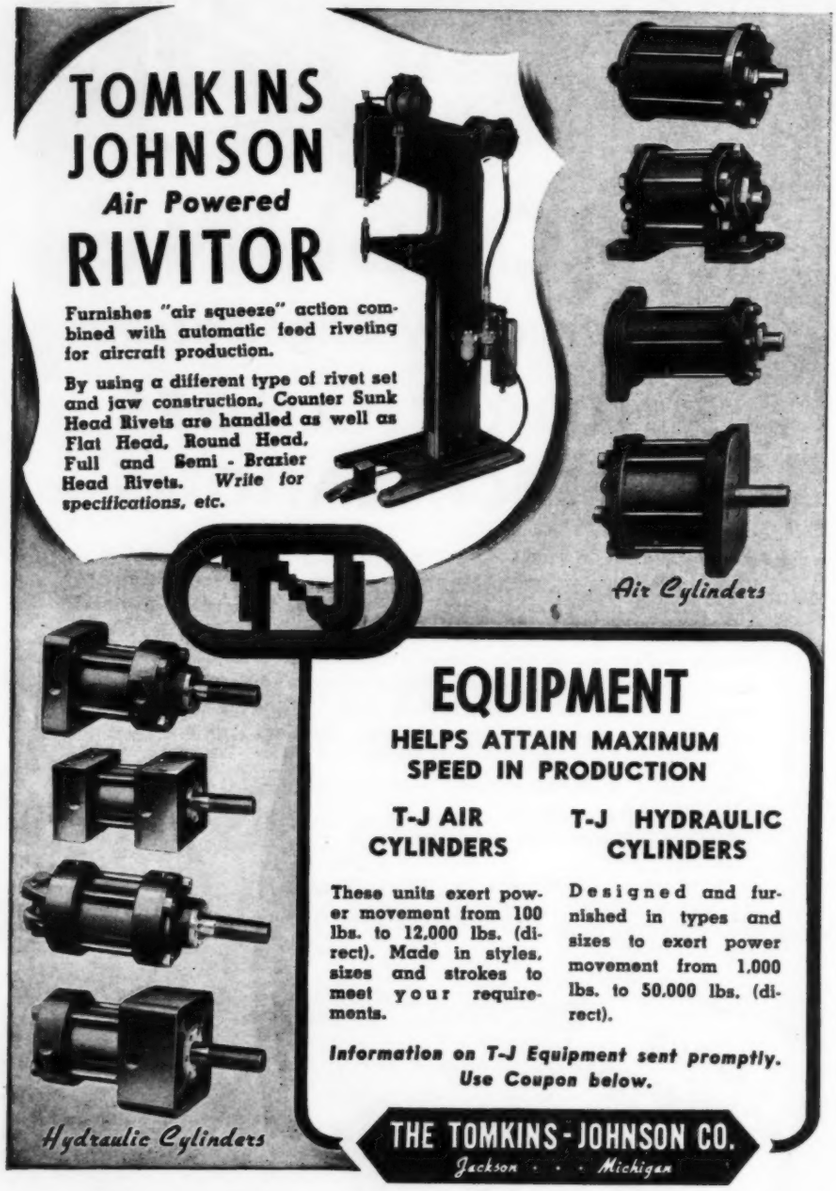
ELECTRIC WIRES AND CABLES

More solid rivet joints per hour
Greater efficiency in air and hydraulic cylinders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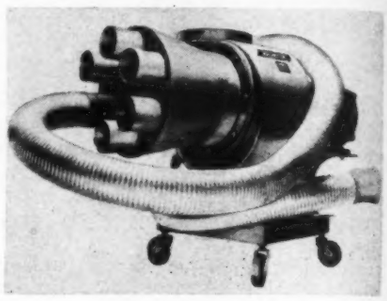
easy maneuvering, and a retaining latch which releases horn instantly. Recommended for fires in flammable liquids, alcohol storage, electrical machinery, and for other Class B and C fires. American-LaFrance-Foamite Corp., Elmira, N. Y.

Exhauster-Ventilator

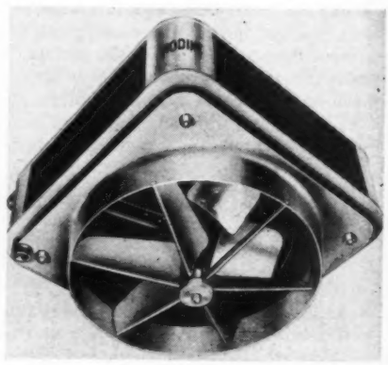
An exhauster and ventilator, called the Octopus, may be placed or hung in any convenient place between the working area and the open air. It is connected by means of flexible metal hoses to the area



to be ventilated. The Octopus is powered by a heavy-duty ball-bearing motor equipped with overload protection. Exhauster can easily be converted into a fresh-air ventilator by simply changing the position of the tube adaptor which is part of the equipment. One to six nozzles can be used. Caps are provided for all nozzles not in use. Chelsea Fan & Blower Co., 1206 Grove St., Irvington, N. J.

Steel Unit Heaters

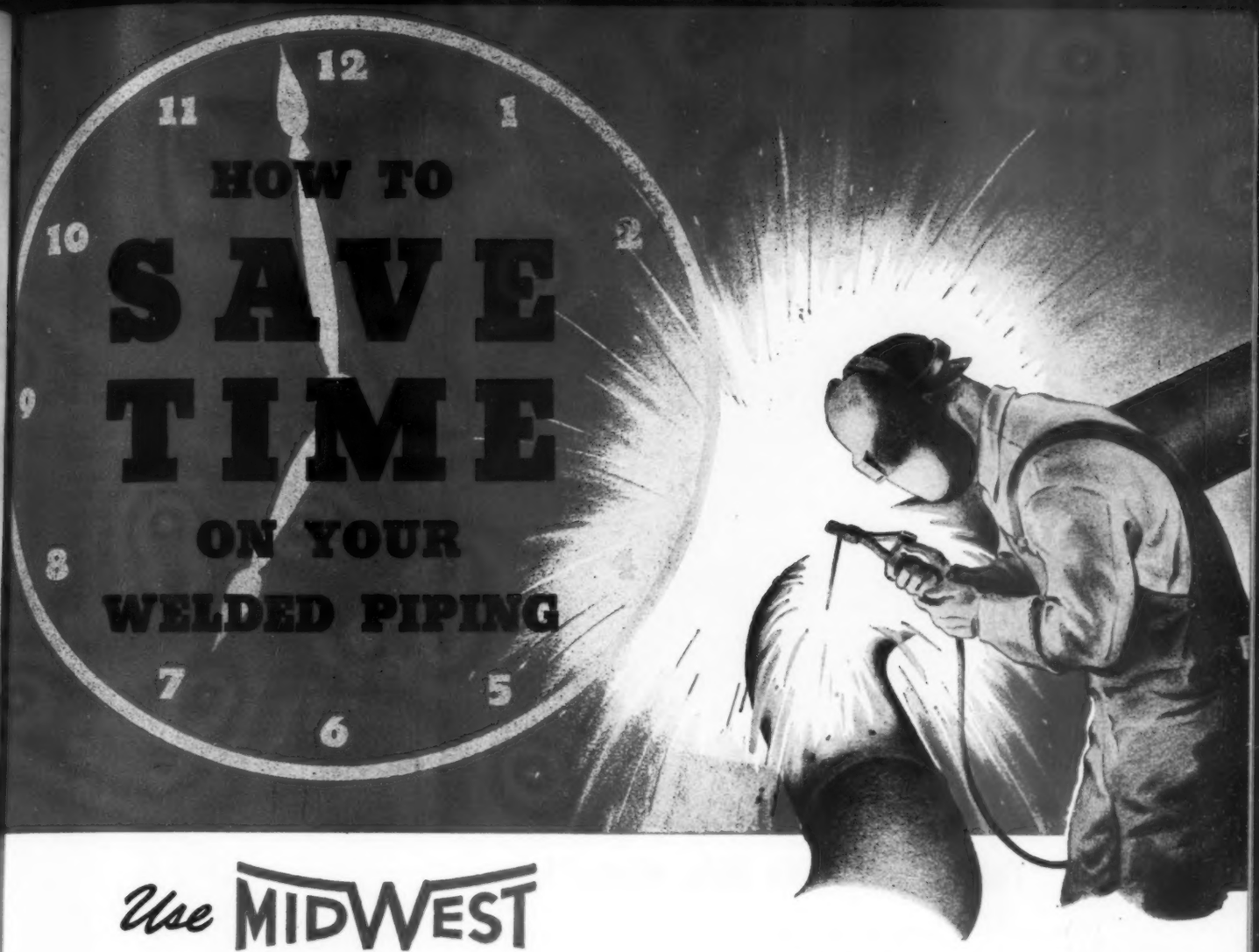
Steel-condenser unit heaters, Style S/S, include both horizontal and vertical delivery types. Ingot iron is used for condenser tubes and headers. Tubes have wall thickness of 0.065 in. Steel fins are permanently



bonded with metal (also mechanically bonded) to the iron tubes, to seal contact of fin to tube from corrosion. To reduce rusting and corroding of fins, completed welded and brazed condenser assembly is dipped in a lead alloy bath. Modine Mfg. Co., Racine, Wis.

Finger Cots

Finger protectors for operators who handle small, rough objects or small, hot articles, such as red hot radio tubes, are announced. Chrome leather finger cot No. 1000 (short type) is suitable for operations in which

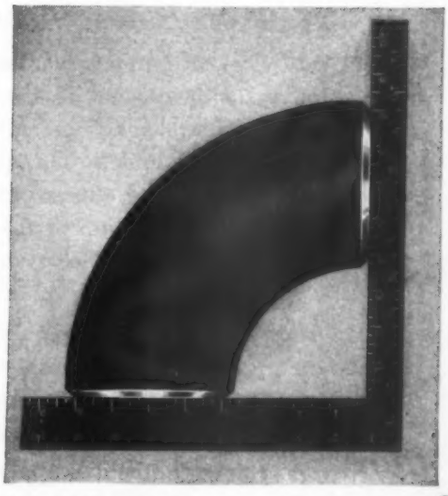


Use MIDWEST
WELDING FITTINGS

Now that "time" is the critical factor on so many welded piping jobs, it is more important than ever before to utilize the time-saving characteristics of Midwest Butt-Welding Elbows.

Qualified pipe welders report that Midwest Elbows save time and trouble on the job because they are always accurately to dimension . . . and because they are always uniform. Time is saved not only in lining up and in welding, but also because all pipe can be cut in advance according to drawings. Another important advantage is that more uniform welds are assured.

These features result from the design and from the unique process used in the manufacture of Midwest Welding Elbows. They are first made slightly oversize . . . then accurately sized in compression at a forging heat. Special fixtures and machine tools assure accurate finishing. Ask for Bulletin WF-41 which gives all the facts.



(above) Exact included angle is the result of special fixtures and tools developed by Midwest for machine-beveling the ends.

(right) Sectional view emphasizes uniform wall thickness and true circular cross-section of all Midwest Welding Elbows (both Standard and "Long Tangent").

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Main Office: 1450 So. Second St., St. Louis, Mo.
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"Take It Out of My Hide, Mister!"

"Wherever you have a mechanical power transmission job, you get most efficient performance out of the tough hides of fellows like me . . . performance only Leather Belting can give."

Right! For, on practically every type of drive, Leather Belting delivers more power at lower maintenance cost than any other material. Its inherent characteristics — greater gripping power, flexibility, tensile strength and longer life — plus the craftsmanship of the tanner, currier and belt maker place Leather Belting at the top of the power transmission list. Furthermore, it is the one material that, even after years of service, has a worthwhile salvage value.

Consult your own Leather Belt maker. Whatever your transmission problems, you can rely on his specifications to meet your need. What is equally important, you get your belting when promised, *for leather is available.*

When you order Leather Belting, you know the goods will be delivered . . . and that it will "deliver the goods."

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In addition to leather for flat and round belting, we manufacture pump, hydraulic, polishing, strap and harness leathers.

only one or two fingers need to be protected, or where there is only an intermittent finger hazard. No. 1001 cot (tie-on) is unusually large, and can be used as a protection for a finger or thumb that is bandaged. Tie-on feature makes it applicable to a number of uses. No. 1688 chrome leather two-finger and thumb protector is available for operations where several movements require finger protection, while succeeding movements require accuracy and sense of touch of a bare hand. American Optical Co., Southbridge, Mass.

Floodlight

Compco floodlights, complete, and ready for installation, are made of one-piece formed steel, and provided with heat resisting lenses insulated to prevent dust or rain from penetrating interior. Mounting method assures unlimited adjustment.

Each light is given a hard, baked-on, plastic enamel surface inside and outside, and due to weather-proof construction, gives dependable service for outdoor floodlighting needs. Fixed focus makes repeated adjustment unnecessary. Available in all sizes from 200-watt to 1500-watt units. Commercial Metal Products Co., 2255 W. St. Paul Ave., Chicago.

Fire Extinguisher

Compound in the form of a harmless, non-poisonous, fine powder, known as All Out, is composed entirely of refractory materials. Puts out fires of magnesium, thermite, aluminum, and similar metals. Emits no gases, fumes or smoke. Retains its entity until temperatures of 2500 degrees are reached, when it fuses into a lava-like form. Heat which is supposed to cause damage actually blankets the fire and kills it, it is claimed. The product does not cake or harden, and keeps its strength no matter how long it is exposed

DISSTON CAN SUPPLY THESE METAL CUTTING BAND SAWS for immediate delivery

Improved production facilities make it possible for Disston to offer these high grade Metal Cutting Band Saws. The fine steel and quality craftsmanship of Disston Band Saws will help you in problems of cut-off work in ferrous and non-ferrous metals—cutting die stock—cutting dies to shape—cutting gates and risers from castings—production cutting.

AVAILABLE NOW!

Disston Hard Edge Flexible Back Metal Band Saws in which the blades are hardened on the tooth edge only are used for operating at low speeds. Teeth are not punched but *milled*—and then set accurately by machine. Two types of set: *Raker Set*, in all numbers of teeth except 32 per inch—for general metal cutting and especially steel, cast iron and tougher alloys. *Group Set*, in 32 teeth per inch only, for thin wall tubing, mouldings and similar shapes.

AVAILABLE NOW!

Disston Hardened Throughout Metal Cutting Band Saws are supplied with either Regular or Pullman type teeth. Made for operating at high peripheral speeds and used for cutting thin sheet metal, non-ferrous alloys, bakelite, micarta and other similar materials.

Ask your distributor for complete information or write today to Henry Disston & Sons, Inc., 1024 Tacony, Philadelphia, Pa., U. S. A.

THE DISSTON CONSERVATION CONTROL PLAN, a nationwide program to save essential tools and materials for greater war production, is now being applied with outstanding success by thousands of plants. Send today for the booklet describing the Plan and containing reproductions of Instruction Cards for workmen, covering 34 different types of cutting tools. The cards are supplied on request, without charge.

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Maintenance of tools is a vital wartime necessity. For this reason, the Dumore Company now offers this practical handbook FREE if requested on your company letterhead. Regularly priced at 25 cents.

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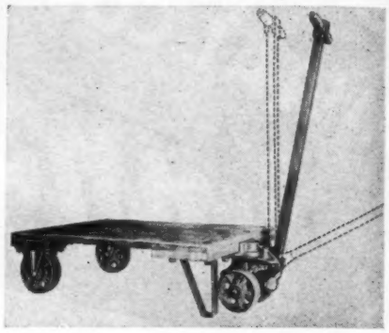
to air, moisture, cold, sun heat, brine, salt air, or chemical fumes.

Packed in 10-lb. paper bags and in 400-lb. barrels. A bag is simply dropped on the fire. Paper burns quickly and frees powder, which is spread over the burning object, burying it. Barrel, with head removed, is placed where fire is likely to occur. A long-handled shovel is hung nearby. United Laboratories, Inc., 16801 Euclid Ave., Cleveland.

Lift Jack

Bond universal jack may be operated with handle in a vertical position, and the load maneuvered in cramped space.

Handle is adjustable to suit any operator's height. Only mechanical movement in entire jack is travel of handle in slot at

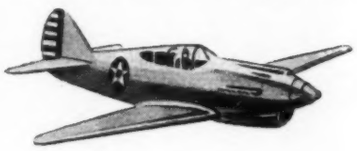


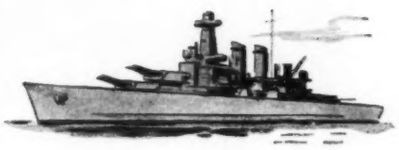
lower end of handle. There is nothing to get out of order, the makers claim. Bond Foundry & Machine Co., Manheim, Pa.

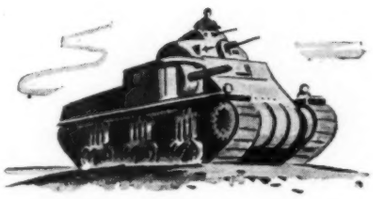
Fluorescent Lamp Starter

Manual-reset fluorescent lamp starter, called the Master No Blink, locks dead lamps out of the circuit and allows instant dead lamp replacement. In automatic starters, a flow of current is required to keep the dead lamp from flickering. With the Master No Blink, no current flows through the ballast after the dead lamp has been locked out. This cutoff feature prolongs the life of the ballast and eliminates the cooling period required for replacement of lamps using automatic starters. A dead lamp out of the circuit

Power is Precious...Use it Wisely!



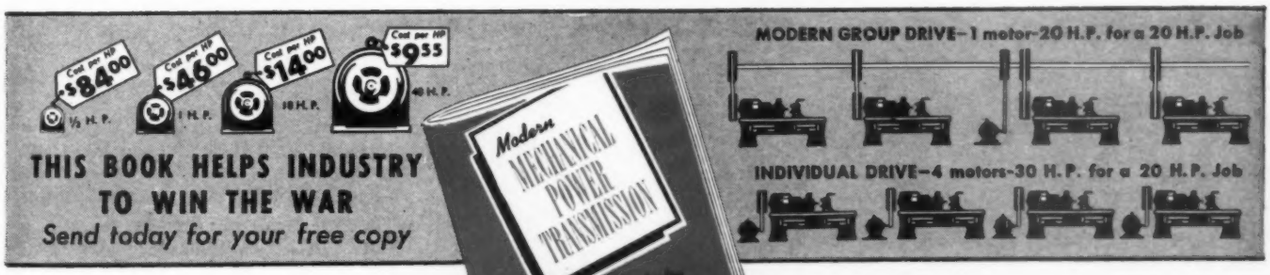




American industry is getting the tools to win the battle of production. NOW a vital job is the *use* of these tools with maximum efficiency. Victory demands every pound of industrial power . . . and the wasting of not one ounce.

The manufacturers and distributors of mechanical power transmission machinery offer this book of practical suggestions for the most efficient use of mechanical drives you now have. Not a bid for orders, not a solicitation to buy, but a *service* by an industry to help win the war.

It explains PLANNED POWER TRANSMISSION, the proper application, use and maintenance of mechanical power transmission machinery. Such PLANNED systems save power, improve power factor, lower connected load, reduce maintenance and unit cost . . . and pave the way to increased output that will help to crush the Axis under an avalanche of American production.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The Power Transmission Council, Inc. represents impartially the manufacturers and distributors of mechanical power transmission machinery. It fosters PLANNED POWER TRANSMISSION, the proper selection, use and maintenance of whatever mechanical equipment will most efficiently transfer power from the prime mover to the machine to be operated.

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POWER TRANSMISSION COUNCIL, INC.
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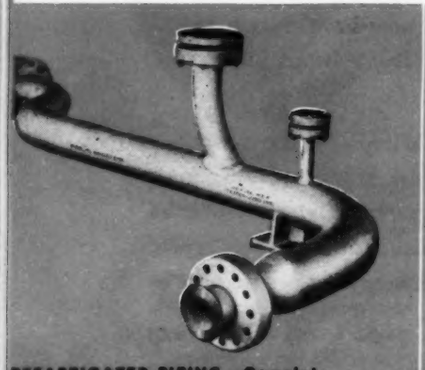
This ad inserted for the Power Transmission Council, Inc., by a manufacturer of mechanical power transmission machinery, in the interests of American industry and the war effort.

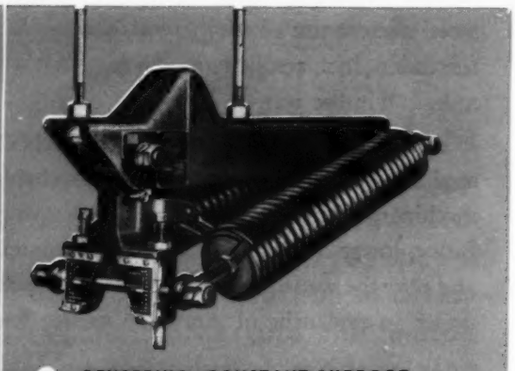
FLUID TRANSPORT — What does it mean? It means carrying steam from a boiler at 2000 pounds per square inch; vapor from a refinery still; gas from a tank; water from a reservoir. It means more than that. It means compensating for such factors as heat and cold, expansion and contraction, pressure – factors as important in themselves as the fluid to be transported. It means the manufacture and fabrication of the many connecting links that convert a pile of pipe into a piping system.

GRINNELL

FLUID TRANSPORT



REFABRICATED PIPING—Complete sub-assemblies that are pre-tested for strength, underwriter approved and easy to erect.



2 GENSPRING CONSTANT-SUPPORT HANGERS—Mass produced, yet prefitted to exact engineered layouts . . . safeguard high-temperature piping systems.

PE AND TUBE FITTINGS—Steel, cast on, malleable iron, brass, aluminum . . . rooved, flanged, socket, flared tube and elding.

4 ADJUSTABLE PIPE HANGERS engineered to provide the right hanger for ANY piping ANYWHERE. Faster to install . . . stronger . . . adjustable after installation.

DATA FOLDERS on these and other Grinnell piping products will be gladly furnished. Grinnell Company, Inc., Executive Offices, Providence, R. I. Branch offices in principal cities of United States and Canada.

GRINNELL

WHENEVER **PIPING** IS INVOLVED

causes a small red button on top of the starter to snap forward. When the worn-out lamp is removed, the red button is pushed in manually to reset the starter. Lamps can be changed without shutting off the current.

Starter is available only for 30-, 40-, and 100-watt lamps. General Electric Co., Bridgeport, Conn.

Alloy Sprayer

Self-contained and portable metal sprayer is designed to spray any neutral alloy with a melting temperature of up to 600 deg. Fahrenheit for protective coating, making templates, spotting or checking dies, and reproducing molds. Requires only

connection with electric power and air-pressure line for operation. Capacity is 12 cubic inches. It is equipped with electrical elements for heating the metal in insulated pot. Temperature control is variable by means of a rheostat switch knob. Thermostat holds the metal at any pre-set temperature. Cover automatically seals the top of the pot. Spraying is accomplished by pressing the trigger on the handle allowing the air to either draw, or force, the metal through the nozzle of the gun. Alloy-Sprayer Co., 2040 Book Tower, Detroit.

Wood Lockers

Lyon lockers and cabinets have a hardwood top, bottom and frame; sides, backs and doors are pressed wood. The doors consist of two panels of pressed wood mounted on a hardwood frame. Five stock sizes of lockers—four single tier and one double tier; three types of cabinets, storage, wardrobe, and combination—in two sizes: 36x18x72 inches and 36x24x72 inches. Shop robes provide full length coat-hanging space and a private locking compartment for each employee. 20-person unit requires less than 14 square feet, 10-person unit less than 7 square feet of floor space. Lyon Metal Products, Inc., 3056 Clark St., Aurora, Ill.

Extension Brush Handle

Adjustable extension handle, known as Adjust-O-Handle, for use with paint brushes, scrapers, and similar tools, permits efficient coverage of large work surfaces from a fixed position, it is claimed. Useful in industrial plant, camouflage, blackout, and other painting jobs. Regularly accepted brushing technique is employed. By manipulation of springs and guide tape, any standard brush (or tool)

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OR

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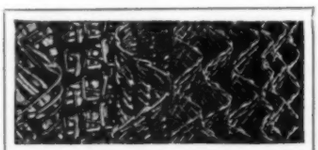
No Air Filtering Problem is Too "Tough" for AIR-MAZE ENGINEERS



ONLY AIR-MAZE HAS THIS PATENTED FILTER MEDIA

Scientifically designed and precisely arranged "maze" of crimped round wire utilizes the "baffle-impingement" principle of air filtration to the highest degree. Provides highest efficiency with extremely low pressure drop. Cleanable. All metal. Nothing to wear out.

In your business, as in ours, there is no substitute for experience. During our 17 years of specializing exclusively in air filtration problems, Air-Maze engineers have designed a size and type of air filter for almost every conceivable application—from the huge filter-silencer shown above to an oil-bath filter small enough to fit in the palm of your hand. Today, our standard line alone includes more than 3,000 variations of the famous Air-Maze air filtration principle.

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DEPENDABLE AIR FILTERS FOR EVERY APPLICATION

Every Shift a "Day Shift" with this "Skilled" Lighting

RLM Duratach Units

Made in Dome, Angle and all other standard types. Wheeler Duratach construction provides for quick and easy interchangeability of reflectors.

RLM Open-End Fluorescent Units

Available in two or three-lamp constructions, units can be mounted from chain, conduit, or directly to ceiling. For use with 48-inch, 40-watt lamps. RLM units for use with 100-watt lamps also available.

Wheeler Installations maintain high-precision lighting levels round-the-clock!

No longer need you count on lower output from your night shifts due to inferior lighting and eyestrain. Modern installations of Wheeler Fixtures give you high-precision "daylight" lighting levels 24 hours a day . . . help to maintain top production with low spoilage on every shift!

Wheeler Lighting is "skilled" lighting, designed to keep skilled eyes working at top efficiency. Developed through 61 years of specialized experience, Wheeler Fixtures apply standard lamps to produce their maximum of useful light per watt. Available in a complete line of industrial types.

Write for catalog of Wheeler Incandescent or Fluorescent Fixtures. **Wheeler Reflector Co., 275 Congress Street, Boston, Mass.** . . . New York . . . Cleveland. Representatives in principal cities.

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can be operated smoothly and efficiently. Flexible spring action saves hand and arm shock. Normal arm and shoulder movements are used. Uses include tarring roofs, treating surfaces under tanks, over or around piping and other remote surfaces, wall and window cleaning, rust scraping, and dusting. Available in standard lengths of 6, 8, and 10 feet; special lengths to order. Adjust-O-Handle Division, Breinig Brothers, Inc., Hoboken, N. J.

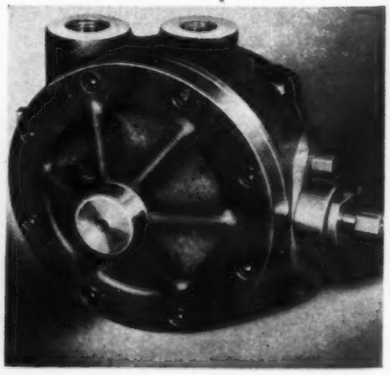
Cleaning Compound

Cleaning compound known as Elektro-Purj-It is better than gasoline or naphtha for cleaning machinery, according to the manufacturer. It is also claimed that the compound will not burn; is harmless to hands and clothes; cleans paint without rubbing; dissolves rust, grease, and weather corrosion; eliminates acids and caustics; disinfects as it cleans; is harmless to porcelain and enamel surfaces; cleans lighting fixtures and reflectors for better light reflection; restores brightness to linoleums, mastic cement, and terrazzo surfaces. Trojan Products & Mfg. Co., 3130 S. Wabash Ave., Chicago.

Control Pump

Automatic machine tool control, requiring high pressure delivery at extremely low volume, is supplied by a vane-type pump. Standard mounting permits the pump to be used as replacement, or as original equipment, without changing current designs.

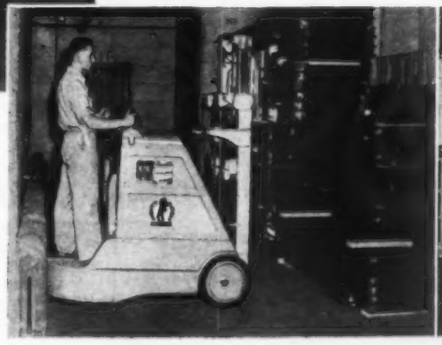
Delivery is infinitely variable from 0 to 4 g.p.m. and operating pressures are 1000 lb. per sq. in. with a top short-interval



MOBILIFT

Speeds the Battle of Production

Tireless workers of steel feed America's production lines . . . eager, untiring MOBILIFTS that accellerate the transition of raw materials into weapons to blast the enemy from the battle fronts of the world. Today MOBILIFTS are helping to set the pace for the greater production lines of a new peacetime America. VAUGHAN MOTOR COMPANY, 835 S. E. Main St., Portland, Oregon.



MOBILIFT

Moves materials like a Giant

Oil Dermatitis must not sabotage machine shop production now!

You want your men to check in with healthy WORK-READY hands—for even a mild infection lowers a man's efficiency, and even minor discomfort may take his mind off his work at a critical moment.

Cutting oil—neglected—can be a constant spreader of dermatitis. DISINFECTION of the cooling compound is an obvious necessity.

This Company's WESCOL* in as slight a quantity as 1½ pints to 50 gallons of cutting-coolant compound should effectively stop the spread of infection, by killing harmful pathogenic bacteria. In comparison with the loss of man-hours and work-efficiency the cost of Wescol is slight, indeed—not to mention the saving in compensation claims.

Wescol is a special-purpose product of notably successful performance which should be known to every Machine Shop in the land.

★**For protection against skin-irritants of other kinds, investigate West Protective Hand Creams.**

★**For basic skin-health we recommend you use Lan-O-Kleen* hand soap—containing emollient lanolin. Sample on request.**

*Trade Mark Reg. U. S. Pat. Off.

WEST DISINFECTING COMPANY

SERVING AMERICAN INDUSTRY FOR OVER 50 YEARS

55 BRANCHES Coast-to-Coast and in Canada

CLIP TO YOUR BUSINESS LETTERHEAD, PLEASE

WEST DISINFECTING COMPANY
Dept. J, 42-16 West St., Long Island City, N. Y.

Please send me your latest bulletins on
( ) Wescol ( ) Protective Hand Cream
( ) Lan-O-Kleen Hand Cleanser

Name of Individual.....Title.....

Company .....

Street and No.....

City and State.....

IF YOU WISH COPIES OF THE COLOR POSTER SHOWN IN ABOVE PHOTOGRAPH, USE COUPON AND CHECK ☐ HERE

W-35

maximum of 3500 lb. per sq. in. A split stator permits selection of adjustment. Adjustment and limit screws allow for varying the delivery. Hydra Motive, Inc., 253 St. Aubin Ave., Detroit.

Universal Floodlights

Inexpensive, lightweight weather-tight, porcelain enamel floodlights for industrial plants are announced. Available in four sizes. E-8 for 75- to 100-watt; E-12 for 150- to 200-watt; E-14 for 300- to 500-watt; and E-16 for 750- to 1000-watt

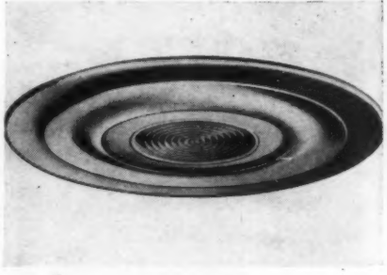
lamps. One-piece reflector housing is made from heavy gage sheet iron with a durable porcelain enamel finish. White porcelain enamel inside housing is separately fired to insure efficiency and durability. Westinghouse Lighting Division, Edgewater Park, Cleveland.

Oil Absorbent Compounds

Oil absorbent compound dries up oil as a blotter dries ink. Manufacturer claims it can be reused; eliminates sawdust, sand, and floor sweeping compounds; keeps floors dry; reduces slip hazard on cement, wood, and steel surfaces; soaks up oil on floor surfaces; keeps floors clean; is harmless to shoes; is odorless, dustless; removes heavy, thick aisle oil and grease accumulation to facilitate better trucking; dries up water-soluble oil, kerosene, gasoline, and various solvents; keeps spray booth floors fresh from contamination. Trojan Products & Mfg. Co., 3130 S. Wabash Ave., Chicago.

Diffuser

Combination supply and return (or exhaust) unit known as Venturi-Flo is designed for use in installations where simplification of the duct layout is of primary importance. It is suited for existing



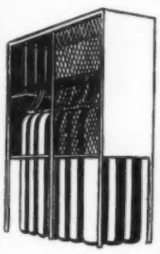
FIRE and how to fight it!

HOW OFTEN SHOULD EXTINGUISHERS BE RE-CHARGED?

Is your plant's fire-fighting equipment in top-notch condition—ready for a sudden emergency?

Even the very finest portable extinguishers cannot retain full effectiveness *indefinitely*.

Some day one of your extinguishers may be called on to save your plant. Insure reliability of your fire-fighting equipment. Follow the simple rules charted below.

CARBON DIOXIDE	DO THIS ONCE EACH YEAR Weigh to detect leakage. If extinguisher shows loss of weight of less than 10% of rated capacity, *stamped on label*, nothing need be done. Recharge if weight loss shows greater than 10%.	WILL IT FREEZE? **no**	
SODA ACID	DO THIS ONCE EACH YEAR Discharge and refill. Mix soda solution outside extinguisher, following manufacturer's instructions. Use lukewarm, not hot water. Wash all parts with water. Examine for clogging or corrosion.	WILL IT FREEZE? **yes** Do not keep outdoors in cold weather.	
PLAIN WATER	DO THIS ONCE EACH YEAR Inspect by removing and weighing carbon dioxide cartridge. Replace cartridge if weight loss exceeds ½ ounce. Inspect hose and nozzle for clogging or corrosion, and check the quantity of water.	WILL IT FREEZE? Ordinarily yes, but some water extinguishers are protected against freezing. Label gives this information.	
FOAM	DO THIS ONCE EACH YEAR Recharge. Mix solution outside the extinguisher according to manufacturer's exact directions. Wash all parts thoroughly with water. Test hose. Examine for corrosion or clogging.	WILL IT FREEZE? **yes** Do not keep outdoors in cold.	
VAPORIZING LIQUID	DO THIS ONCE EACH YEAR Test by partially discharging. Pump a few strokes with extinguisher first aimed upward and then downward. Replace lost liquid, as furnished by manufacturer.	WILL IT FREEZE? **no**	
DRY COMPOUND	DO THIS ONCE EACH YEAR Remove and weigh carbon dioxide cartridge. Replace if it shows loss of weight of more than ½ oz. for 12 lb. extinguisher or 1 oz. for the 20 lb. size. Check quantity of dry compound and determine that it is free-flowing.	WILL IT FREEZE? **no**	
 BUILT-IN CARBON DIOXIDE SYSTEM	DO THIS ONCE EACH YEAR Weigh cylinders to check loss of contents. Blow out carbon dioxide lines. Check all releases, thermostats, tubing, switches, pull boxes and electric lines.	WILL IT FREEZE? **no**	

NOTE: *RECHARGE EXTINGUISHERS IMMEDIATELY AFTER USE, EVEN THOUGH ONLY PARTIALLY EXPENDED.*

MORE EFFECTIVE FIRE FIGHTING

Since December 1941 Walter Kidde and Company has had an unusual war job . . . to make products that save fighting men's lives. These products include high pressure containers for aviation use, special type built-in extinguishing systems, crash trucks, and various flotation equipment.

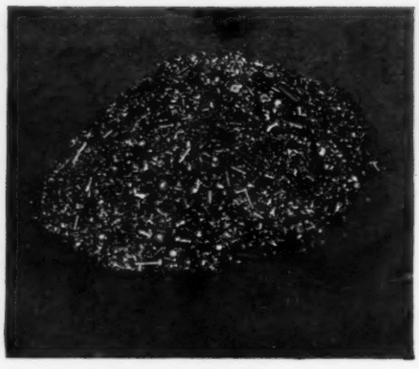
Since we have fewer Kidde extinguishers* to sell, we are trying to make your existing fire-fighting units more effective. If you want reprints of this series of advertisements, just write to

Walter Kidde & Company, Inc.
1012 West Street, Bloomfield, New Jersey

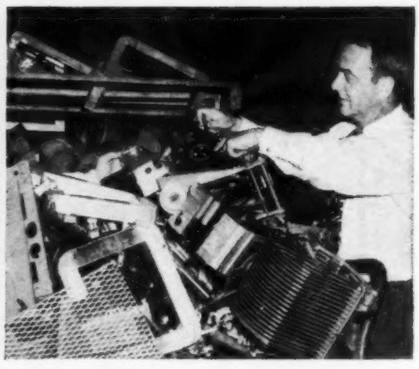
Kidde

*Formerly known as "LUX" extinguishers

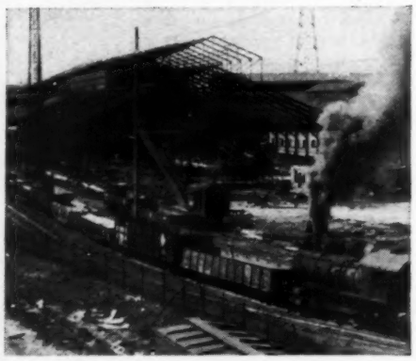
SEGREGATION MINIMIZES SCRAP LOSS—A big aircraft plant doubled its scrap collections through a systematic salvage program. All metal scrap is segregated into solids and machinings, and also by alloy content. Scrap containers are color-banded and labeled to clearly identify what goes into each. . . . *Does your scrap program provide for careful segregation?*



FLOOR SWEEPINGS ARE "PAY DIRT" — Every day sweepings at an eastern war plant yield over 1000 pounds of usable small parts and a big pile of scrap metal. After separation by magnetic separators and mechanical sorting devices, usable parts go back to stock, and scrap is shipped for salvage. . . . *Are you gleaning every pound of metal from your floor sweepings?*



NO HOARDING HERE —A novelty manufacturer recently turned in over two million pounds of metal parts, tools and machinery at scrap metal prices. . . . *Are you holding idle stocks of useless metal parts and equipment for a vague future need?* In most cases they're worth more now to your country as scrap than they'll ever be to you.



WE "PRACTICE WHAT WE PREACH" — In one of many salvage operations, a U. S. Steel subsidiary recently dismantled several of its own buildings no longer suited to present practices. The yield was 3500 tons of steel scrap. . . . *Do you have any steel structures, idle now and of doubtful future value, which should be wrecked for scrap?*

The scrap is coming in
. . . but not fast enough!

WE have the proof that industry is cooperating in the scrap drive . . .proof measured in thousands of tons. But mills must get more iron and steel scrap if they are to meet the gigantic needs of war industry.

Don't forget . . . steel gets to work on the battlefront faster when plenty of scrap is available. Scrap is already metallic; therefore, less ore needs to be converted into pig iron per ton of steel produced.

Segregation of scrap is increasingly important! By making it easy for steel mills to identify accurately the alloy content of your machinings and other scrap, you help to speed production of NE Steels and make possible full utilization of valuable alloys your scrap contains.

AMERICAN STEEL & WIRE COMPANY, *Cleveland, Chicago and New York*
CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
NATIONAL TUBE COMPANY, *Pittsburgh*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*

USS

UNITED STATES STEEL

building work because the return duct may be run to the same point as the supply duct instead of leading to a register at some other location in the room. Removable center section consists of a series of concentric rings. Gasket around the outer edge forms a tight seal with the ceiling. Barber-Colman Co., Rockford, Ill.

Fire Extinguisher

A smothering blanket that snuffs out fire in alcohol, esters, ethers, and other such solvents is known as Alcofoam Powder.

The manufacturer claims that its use with Foamite generators and outlets is satisfactory for products with low flash point. Rate of application is important. Powder is packed in moisture-proof pails holding 40 pounds. American-La France-Foamite Corp., Elmira, N. Y.

Electronic Limit Bridge

Accurate resistance measurements can be made with electronic limit bridge Model No. 670, it is claimed. A direct reading is given of the percent deviation, in either plus or minus direction, of resistance values compared to any predetermined standard.

The dial is calibrated from zero center to 10 percent deviation on either side. With each main division on the dial indicating ½ of 1 percent, fractional divisions showing deviations of 1/10 of 1 percent can be read.

Comparison is made against a predetermined internal or external standard of any arbitrary value selected. Component resistors are accurate to 1/10 of 1 percent and the indicating meter is a 4½-in. galvanometer having a sensitivity of 25-0-25 micro-amperes. Radio City Products Co., Inc., 127 W. 26th St., New York.

Hydraulic Pump

A 6-plunger, fully inclosed, horizontal, hydraulic pump embodies the latest principles of design. All moving parts are pressure lubricated. Connecting rods run in a continuous bath of oil. Roller bearings are used throughout. Maximum capacity is 400 horsepower. Herringbone gears, running in a continuous bath of oil, are used for driving. Pump is compact. Adapt-

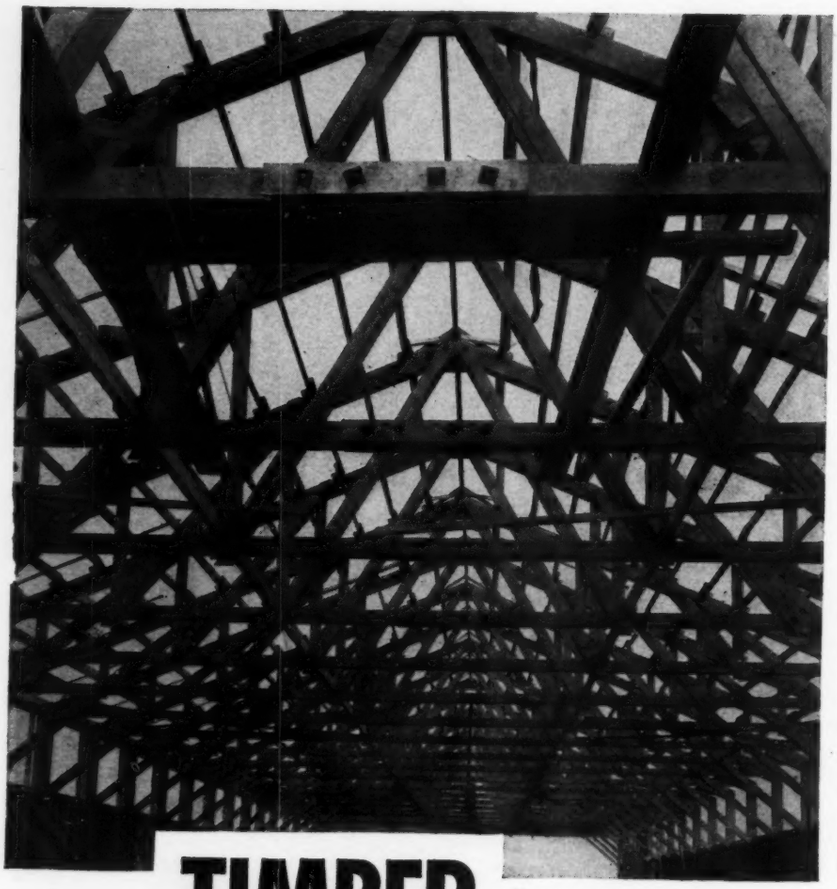
Power to "Finish" War Jobs Faster!

POWER! Plenty of it . . . in husky Van Dorn Portable Electric Sanders . . . for gruelling, high speed continuous production. **VERSATILITY:** Speedy Van Dorn Sanders drive abrasive discs, wire brushes, grinding wheels . . . attachments that make short work of operations too awkward to handle on stationary machines. **RANGE:** Van Dorn "continuous production" Sanders are *built for your job*, come in three sizes (7-in. standard, 7-in. heavy duty, 9-in. heavy duty). **FEATURES:** Husky universal motors, speeds ranging from 4200 to 5000 R. P. M. All vital parts sealed against dust and grit . . . Let your nearby Van Dorn Jobber help you choose the right tools for your type of war work. Or write for catalog to: The Van Dorn Electric Tool Co., 719 Joppa Road, Towson, Md.

"Van Dorn"

(DIV. OF BLACK & DECKER MFG. CO.)

PORTABLE ELECTRIC TOOLS



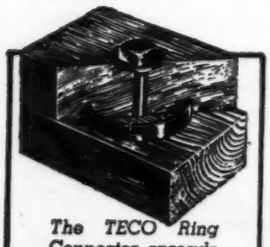
Only **TIMBER** Could Do It—

Engineers Chose Teco Construction For This Canadian Aircraft Plant

"Build it quickly, economically, but well" — these were the contract demands in this recent plane factory expansion. Only timber and the TECO Connector System of Construction could guarantee all three under present conditions.

Twenty-one 51' timber trusses were fabricated for this 240' structure. TECO Connectors were used in all truss joints and at the base of all columns.

Write for more information about this job, and many other timber construction projects using the TECO System.



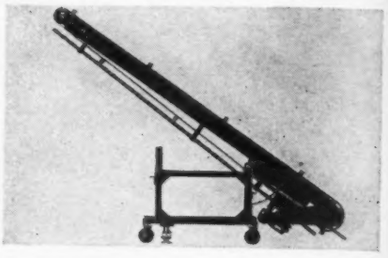
The TECO Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.

Timber
ENGINEERING CO., Inc.
WASHINGTON D. C. ★ PORTLAND, OREGON

able for accumulator systems. Can be equipped with built-in bypass valves or safety valves. Charles F. Elmes Engineering Works, 230 N. Morgan St., Chicago.

Utility Conveyor

A portable, reversible conveyor, 11 feet long, with 14-in. belt, operates from horizontal to 35-deg. positions. Conveyor is



driven by ½-hp. motor, and is provided with wheel, incline, and belt locks. Belt speed is approximately 60 feet per minute. Motor is single-phase, 110 volts with geared head. Lamson Corp., Syracuse, N. Y.

Air Motors

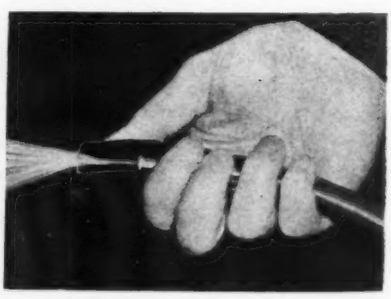
Senacon is the name of a line of air motors, with universal integral valves, for use wherever powerful reciprocating motion is required. Motors save time in opening and closing vises and holding fixtures, operating clutches and latches, moving work pieces and tools to and from each other, and similar operations. The valve lever can be linked to a moving part of a machine for automatic synchronous operation. As prime movers they supply fractional horsepower for such operations as tube flaring, punching, broaching, stamping, die casting and bushing insertion.

A feature claimed by the manufacturers is the dual exhaust ports that provide for ejecting work pieces, cleaning out chips, and permitting adjustment of speed of one or both strokes.

Senacon Air Motors are available in standard models with strokes of 1¼, 2½, 6, and 9 inches. Other sizes ranging from 1-18 inches are furnished on special order. Smith-Johnson Corp., 623 East 12th St., Los Angeles.

Spray Attachment for Fire Extinguishers

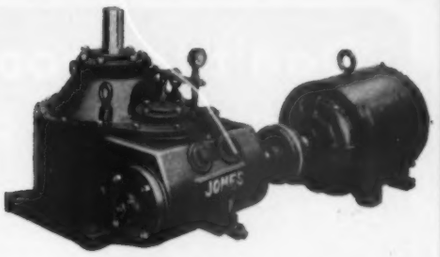
Nozzle attachment called Thumb-Spray has been developed for converting present extinguisher equipment to wartime needs. It simply clamps over the ⅜-in. hose and nozzle of any standard soda-acid, foam, gas-cartridge or pump-tank fire extinguisher. It is a permanent attachment made of



To help you SPEED PRODUCTION

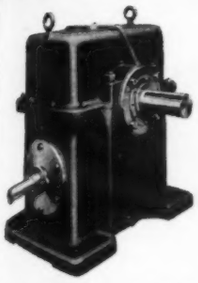
HERRINGBONE REDUCERS

Available in single, double and triple reduction types in a wide range of ratios and ratings.



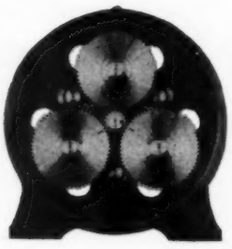
WORM-HELICAL SPEED REDUCERS

A versatile line of double reduction units for agitators, mixers or other applications requiring a vertical shaft drive.



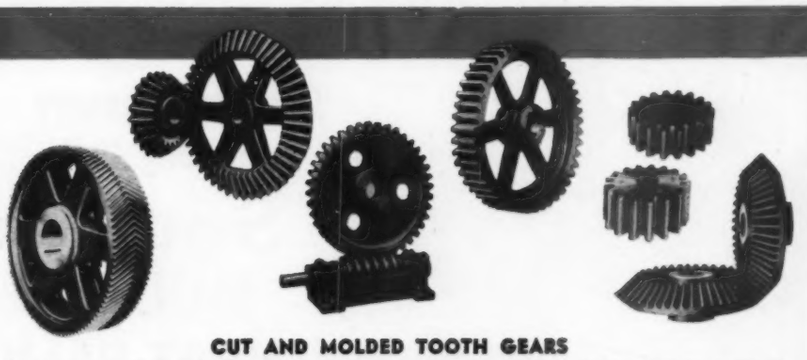
WORM GEAR REDUCERS

Built in light and heavy duty types and in various styles to suit the conditions.



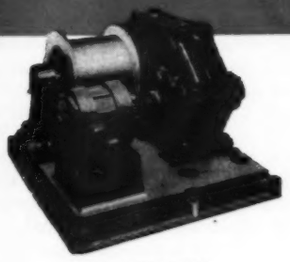
SPUR GEAR REDUCERS

Concentric straight line drive in single and double reduction units.



CUT AND MOLDED TOOTH GEARS

Jones gear cutting practice represents the accumulated technical knowledge of 50 years backed by the finest gear cutting equipment and craftsmanship.
The line covers cut tooth spur, helical, herringbone, worm, bevel, and mitre gears of high test cast iron, steel, bronze, or non-metallic material. An extensive line of patterns is also available for high test cast iron molded tooth, spur, bevel and mitre gears.

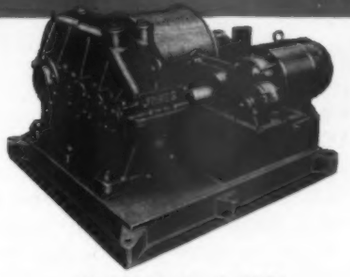


CAR PULLERS

These car pullers are built by Jones as complete units with motor included if desired, or with base to take purchaser's motor. The cable drum is driven by a Jones double or triple reduction Herringbone speed reducer and the control station may be located at a point to give the operator a clear view of the tracks and spotting positions.

DOOR HOISTS

The Jones Door Hoist is a simple, compact and sturdy heavy duty worm gear driven unit that has been widely used in the steel industry for handling furnace doors. It is also applicable to other services where doors of various types must be opened and closed and where it is desired to avoid the complications of limit switches.

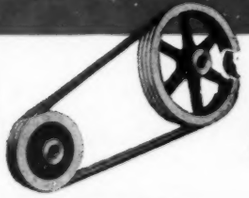


SKIP HOIST DRIVES

Jones Skip Hoist Drives are equipped with all the modern protective devices such as cam or nut type limit switches, solenoid or disc type brakes and slack cable switches. Drives are standard Jones Herringbone Speed Reducers.

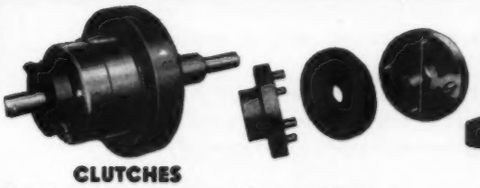
PULLEYS

Jones pulleys are machine molded, poured of high test cast iron, and are accurately finished and balanced. Single arm, double arm, multiple piece and extra heavy conveyor pulleys and flywheels can be supplied.



V-BELT SHEAVES

Made of high test cast iron. Sheaves for "AB" light duty combination and "C" belts in stock with keyseated bushings. Standard and special sheaves for all industrial belt sections made to order.



CLUTCHES

Built for a broad range of shaft sizes and ratings in both enclosed and open types for sleeve and coupling work. In addition they are available in a line of friction clutch pulleys. This clutch modification is also used with gears, V-belt sheaves or sprocket wheels.

COUPLINGS

High and low speed flexible couplings, flange, keyless compression, ribbed and jaw clutch couplings.

PILLOW BLOCKS

Jones Pillow Blocks have double row Timken Roller Bearings locked firmly to the shaft by means of a tapered split steel adaptor and clamp nut. Effective seal retains lubricant . . . easily removed from shaft.

HANGERS

Jones drop hangers, post hangers and bracket hangers are strongly reinforced with arch bracing. Free universal adjustment. Feet are ground.

W. A. JONES FOUNDRY & MACHINE COMPANY
4433 Roosevelt Road, Chicago, Illinois

Jones

BULLETIN No. 80

"Jones Drives for Industry" may be helpful in giving you a complete picture of the Jones products, engineering services and manufacturing facilities that are available. Your request will bring a copy.

Don't let poor ventilation retard your production...

LIKE OPENING YOUR ROOFS *to the Sky!*

This Revolutionary New Ventilating Unit—the Swartwout MULTIPLE HEAT VALVE

gives you large-scale roof ventilation at low cost—and without expensive building alterations

● It doesn't pay you to side-step the question of ventilation. Give careful attention to heat, smoke and fume removal and a plentiful supply of fresh air and you're repaid handsomely by increased production, greater accuracy, fewer accidents. Having the enormous gravity air movement capacity of the Swartwout Multiple Heat Valve is *like opening your roofs to the sky,* yet with full protection from the elements.

Here's an entirely new idea in gravity roof ventilators. It's never higher than 32 inches from curb to top of ventilator—neat and business-like in appearance. Each unit provides 30 square feet of opening for fast air movement through weatherproof low-friction throats that utilize outside air currents for extra suction effect. The Multiple Heat Valve is strong, though light in weight—ideal for use on old buildings as well as new. You can install it anywhere on any type of roof at comparatively small expense.

Before you install any other type of ventilator, be sure to investigate this startling new departure in roof ventilators. For more complete and detailed information . . . write today to

THE SWARTWOUT CO., *18509 Euclid Ave., Cleveland, Ohio*

Swartwout

VENTILATION SPECIALISTS

Also Swartwout Power Plant Equipment

spring steel with a deflector edge which influences the range and distribution of the spray for maximum effectiveness. Normally solid stream is converted into a spray by applying pressure with the thumb at the end of the attachment. Since this conversion takes place only after the liquid leaves the nozzle, the extinguisher itself is not affected. Operating pressures, chemical reactions, or normal streams are not impaired. Pyrene Manufacturing Co., Newark, N. J.

Luminous Signs

Luminous signs, known as Kenmore Luminants, are readily visible in the dark and meet all blackout requirements, according to the manufacturers. Signs are decalcomania sheets. Can be applied to wood,

metal, stone, or other material. Glow for 24 hours after short exposure to light. Available in standard and special types. Kenmore Luminants Co., 444 Old Arcade, Cleveland.

Torque Tool

A torque wrench is made in 4 dial sizes: (1) a unit measuring 0-150 inch-pounds of tension on an outside scale, first revolution, up to 250 inch-pounds on an inside scale, second revolution; (2) calibration range 0-600 inch-pounds; (3) range 0-1200 inch-pounds; (4) range 0-2400 inch-pounds. With four sizes of dials and the calibration range of each limited, dial graduations are larger, more widely spaced.

Dial is set in a special housing inside an extension of the handle, is more rigid, better protected from bumps and shocks that might knock it out of adjustment. Operating accuracy guaranteed to 98 percent, it is claimed. Apco Mossberg Co., 104 Horton St., Attleboro, Mass.

Crane-Load-Carrying Truck

Performs functions of a load carrier, a crane, and a tractor. As a load carrier, the unit has an unobstructed platform 84 inches long by 40 inches wide, by 25 inches high, with a rated capacity of 6000 pounds. As a crane it handles up to 2000

Grind Quicker... Grind Smoother

ON EVERY WAR-TIME JOB WITH THESE

SKILSAW TOOLS!

Here are FIVE kinds of SKILSAW TOOLS you shouldn't be without, if you want to *speed* your finishing operations, *reduce* waste and *increase* your output in war production. Do you have welds to grind down? Stainless steel or brass sheets to polish? Castings to clean? Small machine parts to finish? There's a SKILSAW TOOL for each of these operations . . . and the job will get done quicker and better and at lower cost.

These SKILSAW GRINDERS and SANDERS are typical of the entire line of SKILSAW TOOLS—designed to deliver results under today's stepped-up conditions, built to stand hard usage without time-wasting breakdowns. Look into America's busiest war-work plants and you'll see SKILSAW TOOLS on the job. Ask your distributor for a demonstration and you'll see why!

NEW!

SKILSAW PORTABLE GRINDERS

Just introduced to speed up production on every war-time job...grinding down rough welds, smoothing welding beads, cleaning metals, filing, buffing and polishing on every metal surface. Two Models.

SKILSAW PORTABLE ELECTRIC TOOLS

★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

SKILSAW, INC.
5043 Elston Avenue, Chicago

New York • Boston • Buffalo • Philadelphia • Cleveland • Detroit
Indianapolis • St. Louis • Kansas City • Atlanta • New Orleans
Dallas • Los Angeles • Oakland • Seattle • Toronto, Canada

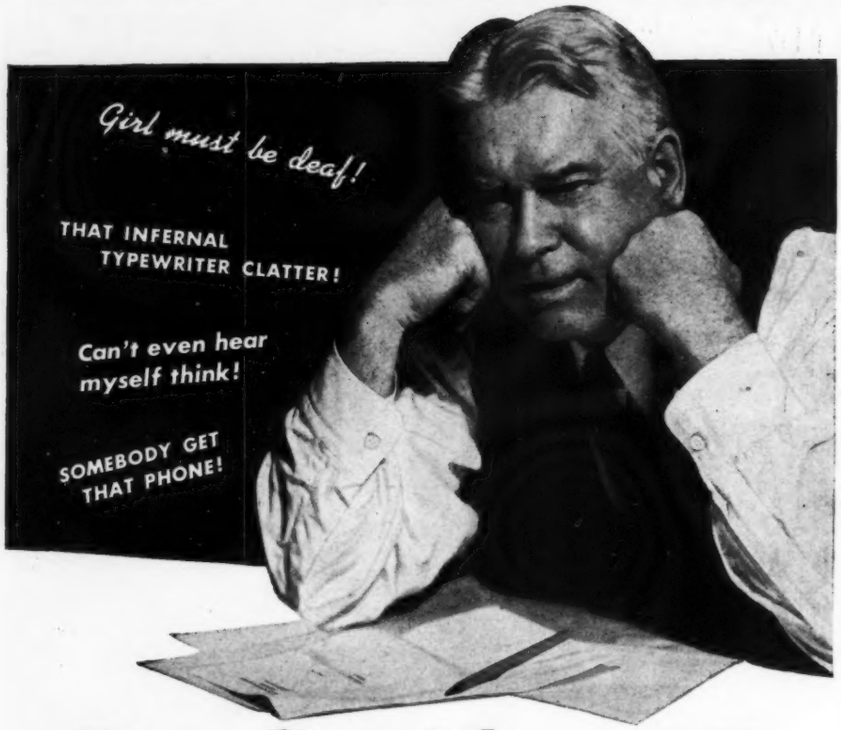
Sanding stainless steel to a perfect finish is faster with SKILSAW Disc Sanders. Also remove waste metal, buff and polish on flat or curved surfaces.

SKILSAW Belt Sanders speed up all "final-finishing" on flat surfaces of bronze, brass and all sheet metals. Quickly remove paint and varnish.

SKILSAW Hand Grinders are swifter, better on all grinding of jigs, dies and for precise finishing on intricate machines and castings.

Spotted conveniently throughout the plant, SKILSAW Bench Grinders speed production, keep tools and twist drills sharper . . . grind small parts quicker.

Excessive NOISE wastes Precious Time!



Stop it with a J-M Acoustical Treatment!

WHEN you have to fight to concentrate, there is more lost than time! In busy plant offices today, uncontrolled noise can also cause mistakes, bad tempers . . . and worst of all, work slowdowns.

But it's easy and surprisingly inexpensive to eliminate distracting noise with J-M Acoustical Materials. They hush noise to an undisturbing level, and can be quickly and easily installed. These fireproof, durable materials pay dividends in increased efficiency, fewer mistakes and better morale.

FOR COMPLETE DETAILS, write for the J-M Sound Control Catalog, AC-26A. Johns-Manville, 22 East 40th Street, New York, N. Y.

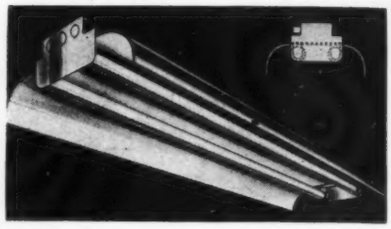
JM JOHNS-MANVILLE

SOUND-CONTROL MATERIALS AND ACOUSTICAL-ENGINEERING SERVICE

lb. at 42 inches on the boom. As a tractor, it loads the trailers by means of the crane, then hauls them at speeds up to 5 miles per hour. Truck operates with 2-wheel drive and 4-wheel steer. Frame is made of formed plates welded into a one-piece structural unit. The boom of channel members, tie rods, lattice bars and gusset plates slews around a 3½-in. diameter alloy steel pillar. Thrust load is taken on ball bearings at the base of column; radial loads on roller bearings at both top and bottom. Listed under the Underwriters' Laboratories' re-examination service. The Elwell-Parker Electric Co., Cleveland.

Hardboard Reflector Unit

The Maze-Lite reflector for two or three 40- and two 100-watt fluorescent lamps is formed of sturdy pressed wood in lieu of steel. Accessory housing is of steel and features Side-of-Channel starter-switches



and end-plates which extend behind the lampholders. Can be attached to conduit or to chain-hanger. When jack-chain is used, no angles or extra parts needed. Edwin Guth Co., 2615 Washington Blvd., St. Louis.

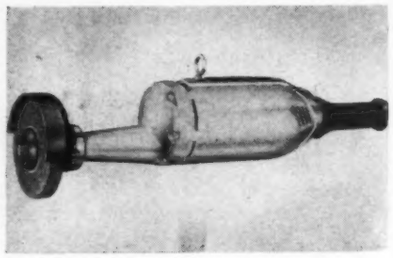
Brick-Aging Finish

A finish giving new bricks a weathered appearance makes an addition or alteration to a brick structure aged by soot, smoke, or factory dust, blend in with its surroundings.

Justrite Brick-Aging Finish conceals the addition of a few new bricks to a building. One pint of the finish will cover 500 square feet of brick, it is said. Louis Melind Co., Chicago.

Portable Grinders

Both the 4-in. Model AD and the 5-in. Model AE portable grinders contain ball bearings mounted in steel inserts on armature and extreme ends of wheel spindle to absorb thrust, eliminate vibration, and insure cool operation. Commutator and switch are fully inclosed for protection against dust, and straight-line ventilation blows dirt away from operator, prevents



The First Truly RUBBER-like Plastic

. . . with challenging post-war possibilities!

THIS soldier's girl will have to wait until after victory is won. But once expansion of production facilities is possible, the plastic that replaces rubber in this soldier's G.I. Raincoat has possibilities that may affect her living—and your business—in a score of interesting ways.

The plastic is Monsanto's Saflex, originally developed from the family of synthetic resins known as vinyl acetals to serve as a tough, resilient interlayer in high test safety glass.

Now, thanks to recent advances in its formulation, Saflex qualifies as the first truly rubber-like plastic and it can be supplied in thermoplastic or thermosetting forms . . . can be vulcanized and otherwise handled much like rubber . . . can be extruded into threads, tubes, or sheets . . . molded by compression or injection . . . or applied to fabrics by calendering or spreading all with equal facility.

At present, all available Saflex will be required for vital military needs. It is already replacing rubber in Army rain coats, Marine Corps water bags, Chemical Warfare gas protective curtains and a surprising list of military items formerly made from rubberized fabric. Molded heels of both thermosetting and thermoplastic Saflex are being field tested on several thousand pairs of Army shoes, where they promise to outwear leather and reclaimed rubber. Extruded tubing has been approved for Civilian Defense stirrup pump hose.

What the availability of materials as promising and versatile as the new Saflex compounds will mean in post-war years is anyone's guess. This much is certain, however, *you will be hearing and seeing more and more of Saflex as a key factor in post-war plans for industrial products and consumer goods alike!* MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield, Mass.

MONSANTO PLASTICS

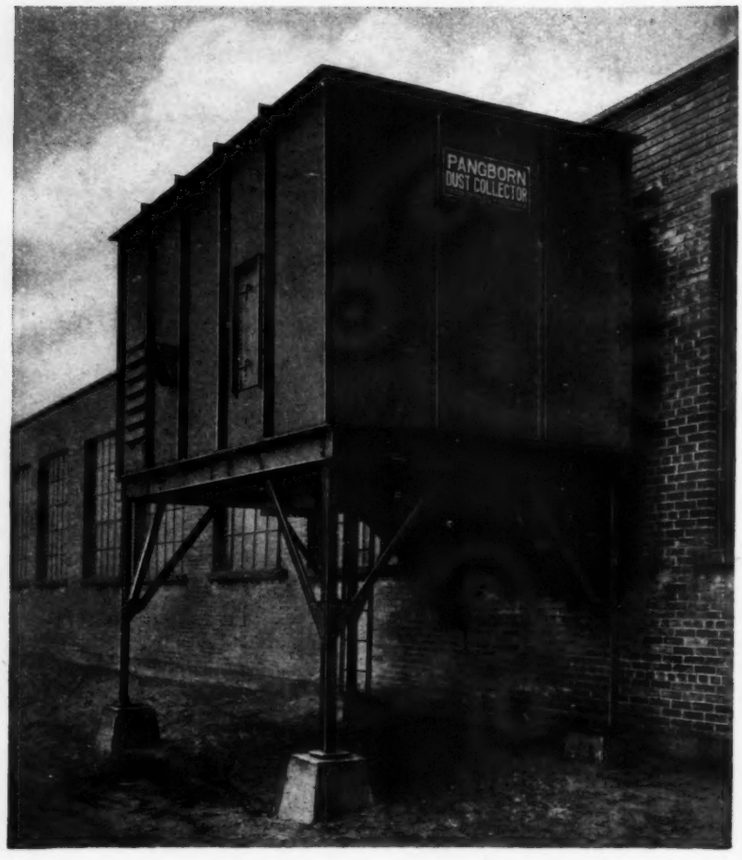
SERVING INDUSTRY . . . WHICH SERVES MANKIND

THE FAMILY OF SIX MONSANTO PLASTICS

(Trade names designate Monsanto's exclusive formulations of these basic plastic materials)

LUSTRON (polystyrene) • **OPALON** (cast phenolic resin)
FIBESTOS (cellulose acetate) • **NITRON** (cellulose nitrate)
SAFLEX (vinyl acetal) • **RESINOX** (phenolic compounds)

Sheets • Rods • Tubes • Molding Compounds • Castings
Vuepak Rigid Transparent Packaging Materials



Doing a Big Dust Control Job in

CANADA

As in our own United States, workers in Canadian war plants need protection for themselves and their machines from the many DUST HAZARDS that always come with stepped-up industrial production.

Eager for the BEST, Canada too, comes to Pangborn for foolproof, efficient Dust Control.

The picture above, taken at one of the largest munition plants in the Dominion, shows a typical small Pangborn installation doing a BIG JOB removing dust from a blast cleaning department in a steel foundry.

If you have any dust problem, large or small, do not delay longer. COME TO PANGBORN TODAY.

PANGBORN

WORLD'S LARGEST MANUFACTURER OF DUST COLLECTING AND BLAST CLEANING EQUIPMENT

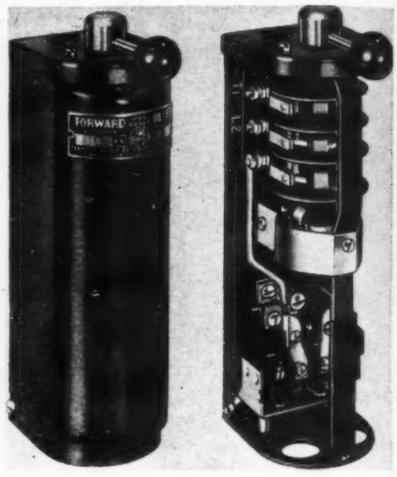
PANGBORN CORPORATION · HAGERSTOWN, MD.

clogging. Steel gears, heat-treated for long life and spline-mounted on shafts, are both strong and quiet. Features universal motor and rubber sleeve handle.

Skilsaw Model AD Portable Grinder is 22 inches long, weighs 15 pounds, no-load speed of 4500 r.p.m., grinding wheel 4x$\frac{3}{4}$x$\frac{1}{2}$ inch. Model AE grinding wheel, 5x$\frac{3}{4}$x$\frac{1}{2}$ inch, operates at 4200 r.p.m. Weighs 18 pounds and is 22$\frac{3}{8}$ inches long. Skilsaw, Inc., Chicago.

Reversing Drum Controller

Reversing drum controller has a built-in polyphase thermal overload unit. In case of overload in any phase, power is disconnected independently of the reversing part of the controller, and an overload is signaled by a red indicator which projects through the top of the controller



housing. Overload unit is of the solder-pot type and is trip-free. It cannot be reset and power reconnected until the drum handle has been returned to the Off position. Furnas Electric Co., 426 McKee St., Batavia, Ill.

Resin-Emulsion Paint

Resin-emulsion paint, called O'Lite, may be used on almost any kind of interior surface it is claimed. Comes in paste form and is available in eight colors and white. Requires no primer or sealer. Gives an opaque, cloud-free job in one coat. Said to be applicable with brush or spray over new or old painted plaster, wood, brick, cement, wallpaper, concrete, acoustical board, metal. Has no odor, and may be washed with soap and water. Dries in one hour to a flat finish. Covers approximately 700 square feet per gallon, depending upon the type of surface to be painted. O'Brien Varnish Co., South Bend, Ind.

Automatic Scale

An automatic weighing scale provides rapid and accurate handling of coal and other free-flowing bulk materials, according to the maker.

A feature of the scale is a vibrating metal feeder deck which conveys material from feed hopper to weighing hopper. The Beaumont-Vibro scale is totally in-

They can't let it happen HERE

For modern field radio telephones, the Signal Corps depends on unfailing wires and cables of copper for the efficient operation of their communication system. Wire failure would be serious.

Just as important as the part they play in any individual instrument, is the part played by electrical wires and cables in the plants that are producing radio equipment. For wire failure here would interrupt production itself.

ELECTRICAL WIRES AND CABLES OF COPPER ARE THE LIFE LINES OF OUR NATION

Anaconda Wire & Cable is devoting its entire production wholeheartedly to our country's war effort . . . turning out the most modern types of copper wire and cable, engineered to fit the job . . . and doing it *seven days a week!* Meanwhile Anaconda research carries on, the laboratories keeping pace with the production effort. The benefits of this intensive program of research are for our country's war effort. But when the emergency is ended, it will be available to industry everywhere.

MINUTE WIRES FOR MIGHTY JOBS

Thin strands of research-developed Anaconda magnet wire make coils for huge tanks as well as 14 pound field radios. If you have a magnet wire or coil problem, send it along. Anaconda can help with production facilities and engineering service, *now!* 42228

ANACONDA WIRE & CABLE COMPANY
Subsidiary of Anaconda Copper Mining Company
GENERAL OFFICES: 25 Broadway, New York
CHICAGO OFFICE: 20 North Wacker Drive
Sales Offices in Principal Cities

Two marks of achievement — The cherished Navy "E" (awarded to two of our plants) for achievement in production...the Anaconda trade-mark for achievement in quality.

ANACONDA WIRE & CABLE COMPANY

WHAT!! Beat the Axis with REFLECTORS?

OF COURSE, it takes planes, tanks, and guns to win a war. But in the plants that make these things, *light* is considered the important factor in speeding eyes and hands, reducing errors, assisting precision workmanship. Hence, reflectors are playing a vital role in helping to defeat the Axis.

To get more weapons to our fighting men *faster*, new Goodrich developments in industrial lighting help keep war production at top speed with such modern fixtures as the Highlite Reflector. This high mounting porcelain enameled fixture provides abundant illumination for large industrial interiors without glare or shadow to interfere with comfortable vision. Catalog sheets on request.

RLM

Protecting vital plants with floodlighting—saving man-hours in production—Goodrich Industrial Fixtures are serving America's war effort everywhere.

Goodrich Highlite Reflector

SOLD ONLY THROUGH ELECTRICAL WHOLESALERS

GOODRICH
ELECTRIC COMPANY
OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 4604 BELLE PLAINE AVENUE, CHICAGO, ILL.

closed in a dust-tight welded steel case. Three standard units are available, to handle from 1 to 30 tons per hour. Larger sizes having weighing capacities up to 60 tons per hour can be furnished. Beaumont Birch Co., 1509 Race, Philadelphia.

Receptacles

Receptacle for installation in Wiremold No. 2100 Plugmold, known as No. 2127P, is a 3-wire polarized receptacle (10 amp. 250 volt; 15 amp. 125 volt) especially adapted for installations where a solid ground is required for small tool motors. No. 2127S Universal type receptacle is designed to take plugs with either parallel or tandem blades. The Wiremold Co., Hartford, Conn.

Portable A.C. and D.C. Instruments

Portable a.c. and d.c. instruments, identified as P-14, are for general field service use where an inexpensive unit is required.

Design, accuracy, sturdiness, and reliability are claimed as outstanding features of these units. Molded cases are fully insulated and magnetically shielded from stray field influence. Available with or without covers. Scale length is 3.2 inches a.c., and 2.8 inches d.c., and units

have an accuracy of plus or minus 1 percent of full scale. Instruments are equipped with mirrored dial and knife-edge pointer, and embody a variety of single, and multi-ranges providing for the measurement of a.c. volts, amperes, and milliamperes; d.c. volts, amperes, milli-amperes, and micro-amperes. Combinations such as four current and three voltage ranges are available. Westinghouse Elec. & Mfg. Co., E. Pittsburgh.

Solderless Connectors

Multiple connectors of pure copper require only a wrench or pliers to install and are able to carry sustained overloads. No LU4 holds wires from 0 to 350,000 c.m. and LU6 holds wires from 250,000 to 500,000 c.m. They have passed the tests of the Underwriters Laboratories and have been approved in every way, it is claimed. The Ilsco Copper Tube and Products Co., Mariemont, Cincinnati.

REEVES *Motodrive*

is Motor + Variable Speed + Gear Reducer

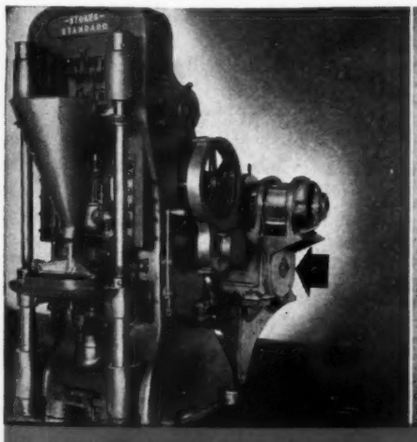
—*All in 1 Compact Unit!*

Install This Space-Saving Drive on Your Production Machines and Give Them "Fighting Speeds" for Faster Output

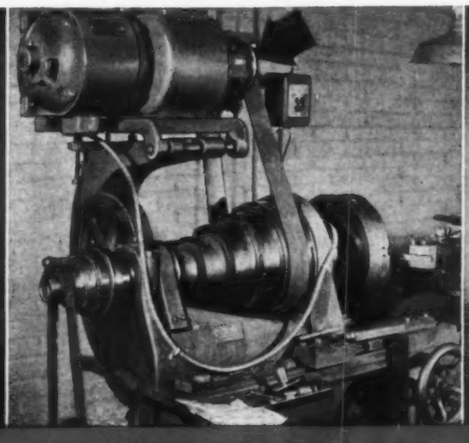
● On production machines where space is limited, or where direct connection to machine is necessary or desirable, the REEVES Motodrive solves the problem of providing infinitely variable and accurate speed regulation. This compact assembly of constant speed motor, variable speed mechanism and gear reducer (if needed) utilizes proved REEVES principle of a V-belt driving between two pairs of cone-faced discs adjustable to form an infinite number of driving and driven diameters. Any desired speed between predetermined limits is available at turn of REEVES Speed Control handwheel—*without stopping* driven machine.

The Motodrive is not restricted to any one make of motor. The unit is available, with or without speed reducer, in two designs, vertical and horizontal. Sizes from 1/4 to 10 h.p. and speed ratios from 2:1 through 6:1. Many different assemblies as to motor, output shaft, handwheel and speed reducer make the Motodrive adaptable for application to any driven machine. Gives any machine "fighting speeds" for more output. For further information on the Motodrive and two other basic REEVES units—Transmission and Vari-Speed Motor Pulley—send for 124-page Catalog Manual F-419.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA



REEVES Motodrive provides full-range stepless speed variation on this Stokes Standard Press. This press capable of applying 100 tons pressure in forming plastic or powdered metal parts.

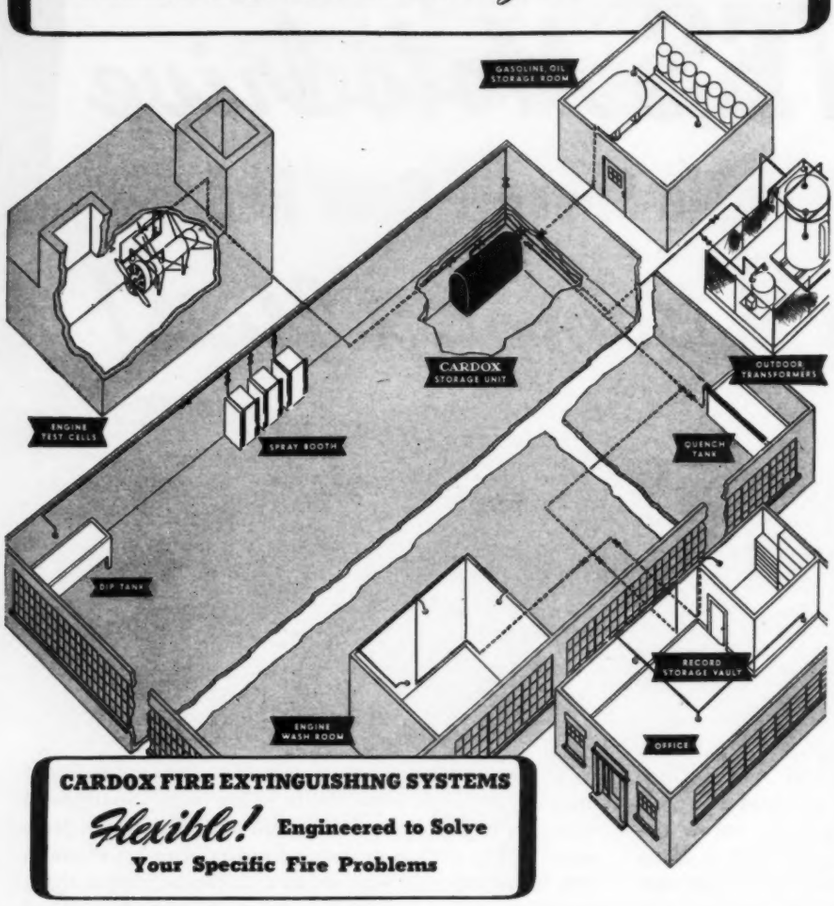


Lathe equipped with the new REEVES Machine Tool Drive. Note curve in sturdy bracket for proper clearance in mounting variable speed unit, in this case the REEVES Motodrive, horizontal design.

REEVES-driven Rotary Carburizer, manufactured by American Gas Furnace Co. Motodrive insures wide range of retort speeds and regulates retort speed for any desired heating period.

A SINGLE SYSTEM

Protecting *One* or *Many* Fire Hazards



CARDOX FIRE EXTINGUISHING SYSTEMS

Flexible! **Engineered to Solve Your Specific Fire Problems**

Men responsible for uninterrupted war production know the damaging setbacks that can be caused by fire. But the wide variety of hazards, existing in virtually every plant and shop, presents a difficult problem. Adequate fire protection must be provided *for each*. Differences in hazards, floor space, layout and size call for a fire extinguishing system engineered for over-all plant requirements.

Cardox Systems meet that specification fully. The schematic view shown includes a combination of fire problems so diversified as to be met with infrequently in industry. Yet one Cardox System, with its single storage unit, can be engineered to the job. It provides today's sound method of swift extinguishment, with little or no loss, damage or delay to equipment or production.

The flexibility of Cardox Systems permits easy installation in new construction or existing buildings. More data on this and the many other Cardox qualities can be had by writing for Bulletin 11102.

CARDOX CORPORATION

BELL BUILDING, CHICAGO, ILLINOIS

District Offices in: New York • Detroit • Pittsburgh • Cleveland Kansas City • Atlanta • San Francisco • Los Angeles • Seattle

CARDOX

NON-DAMAGING FIRE EXTINGUISHING SYSTEMS

Expediters Are the Cure for Production Headaches

(*Continued from page 82*)

operation now. Machines thus enlisted for full 7-day work are distinguished with a small metal "victory flag," bearing a white star on a dark field and fastened to a high part of the machine.

Expediters within the plant keep busy, but they write no records. There would be no point in embarrassing any workman by reminding him of any temporary troubles he may have had. An expediter is like the oil and grease that keep machinery flowing smoothly—his success is written not in lengthy reports, but in increased output, for which he shares the credit.

Other expediters, however, do make detailed and periodic reports. They are the expediters whose work is to follow up subcontractors and suppliers and keep an even flow of goods to the machine tools.

One of the most important duties of these expediters is inspecting new plants and developing additional manufacturing facilities. All machine shops, foundries, and other sources are completely inspected for capacity, attitude of personnel, and financial status, before a contract is issued.

Helps the Subcontractor

Following the placement of a contract, the expediter assists the subcontractors in laying out and planning their job with reference to tools, jigs, fixtures, gages, and delivery schedules; and in forestalling lost machine time and man-hours by pointing out peculiar difficulties in the assembly to be manufactured.

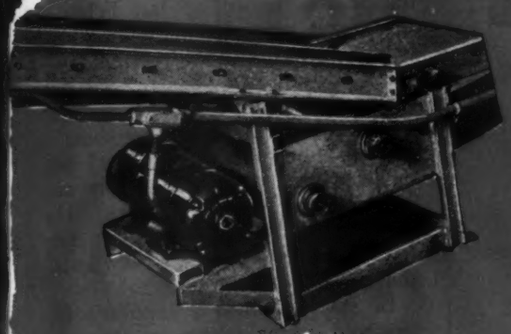
That is, the expediters do not want any subcontractor to be unable to handle a contract once he has accepted it. Rather, the expediter makes sure the subcontractor knows the requirements of his job and can produce according to Army specifications, so that when the parts arrive at the company's main plant they can be bolted into place with a minimum of inspection and almost no rejections.

Further, expediters check back along the line, doing a follow-up job which perhaps the small manufacturer does not know how to do, or has not the skilled help to tackle. In many cases it is necessary for the expediter to solicit the aid of local Ordnance officials or to pass the necessary information on to Firestone, so that they can expedite the purchase of raw material.

An expediter's job also includes the

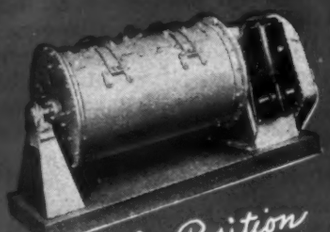
MASTER Uni-Brake Motors

Speed up Production save time by stopping quickly with a compact integrally built brake unit



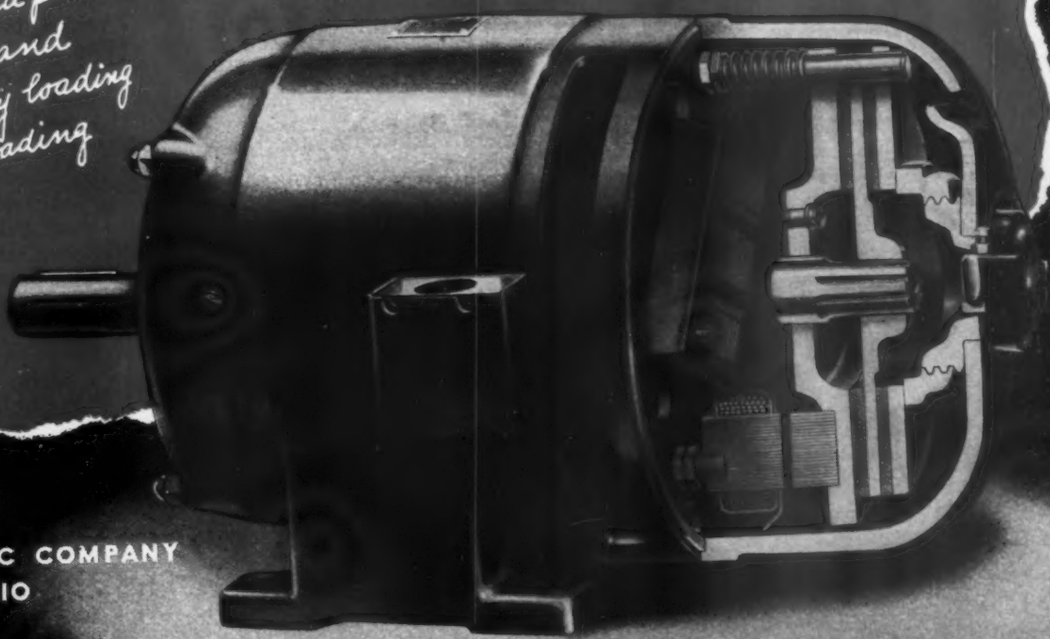
Stop for Safety reduce the hazard to the operator or damage to equipment

Stop and Hold any Load very advantageous on elevators, hoists and inclined conveyors

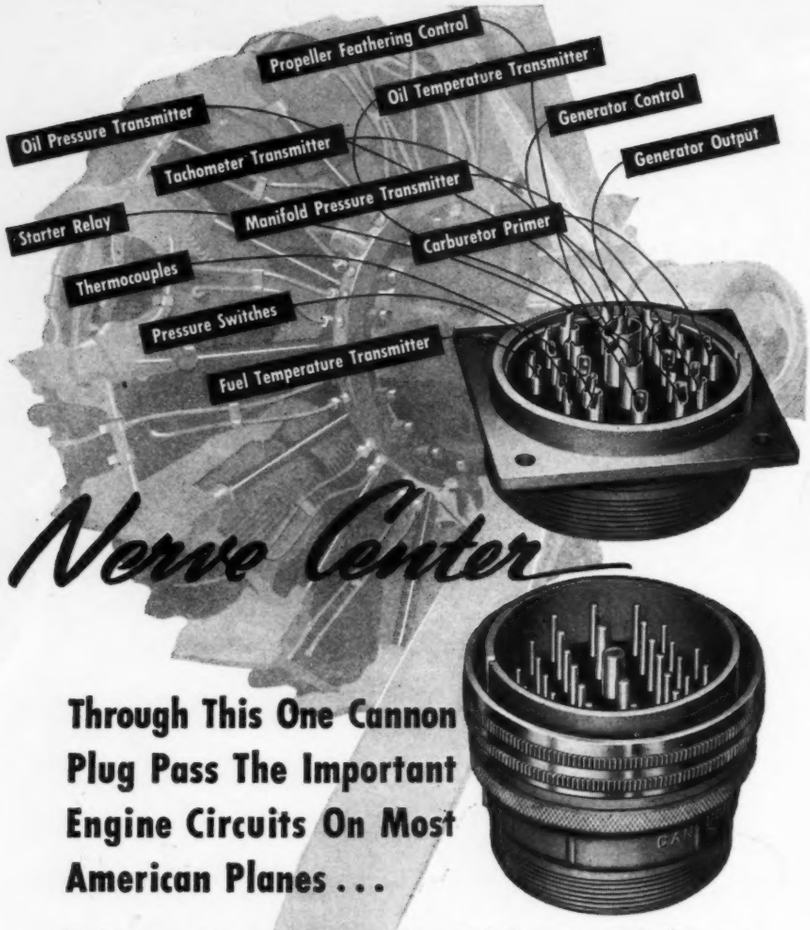


Stop for Position at the desired point for quickly and conveniently loading and unloading

Operates in any Position supplied with ball bearings throughout so it will operate in any position



THE MASTER ELECTRIC COMPANY
DAYTON, OHIO



Through This One Cannon Plug Pass The Important Engine Circuits On Most American Planes . . .

This connector, or Cannon Plug, as it is commonly known, is mounted on the firewall immediately back of the engine. On the engine side are wires coming into it from the controlling and indicating devices on the engine. On the other side a conduit carrying fifteen cables leads to the cockpit instruments and controls.

The maze of vital electrical circuits on an aircraft engine can be connected or disconnected instantly through this single plug—saving hours of time in servicing or overhauling engines.

Many types and sizes of Cannon Connectors are used throughout the electrical systems of America's fighting and commercial planes. The radio system, direction finder, controls on wing and tail assemblies and motor controls are made more flexible by the use of Cannon Connectors.

The aircraft industry is only one user of Cannon Connectors. They are standard equipment in motion picture studios, radio and television stations, in Army tanks, in railroad rolling stock and in countless war and civilian uses where connections must be made quickly and with positive security.

CANNON

CANNON ELECTRIC
DEVELOPMENT COMPANY
LOS ANGELES, CALIFORNIA

scheduling and delivery of finished parts so that they can be blended with requirements of Firestone and the War Department.

Expediters also periodically follow up each job from subcontractors (1) to encourage refinement in design; (2) to improve production methods in order to make "more parts quicker," (3) to secure better forecasts of production, (4) to schedule material according to contract needs.

Stepping Up Production

Suppose, for instance, a subcontractor was signed up last February to make a certain type of pedal assembly for anti-aircraft. He has been getting under way slowly, but has promised that by July 1 he can and will ship ten finished assemblies a day, and beginning August 15 will step this up to fifteen a day and hold it there, or even better it. The expediter calls around at this subcontractor's plant, spends a few hours, and makes his report.

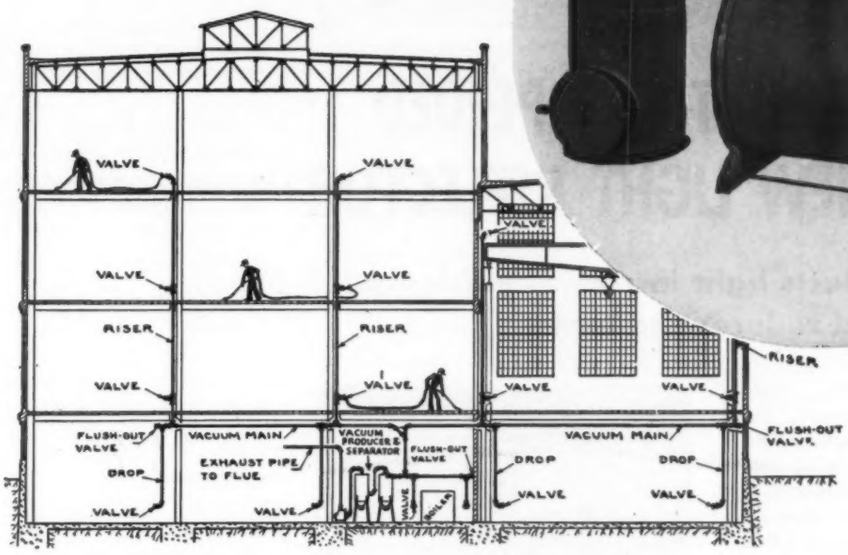
In stepping into a supplier's factory and asking questions, the same situation arises that exists in any firm's home factory—namely, is the expediter trying to bawl somebody out, or is he trying to be helpful and friendly? Here again Firestone expediters aim to be detectives looking for any cause of delay, rather than to lay down the law for any violation of contract. In fact, the expediters take their work so seriously and are so anxious to help that many times they do things that no printed list of instructions for such a job could have anticipated. The whole job is to do everything within reason to get out the goods, and therefore a man selected to be expediter is a man of known reliability and judgment and definite resourcefulness and initiative.

A Remarkable Job

How does it work out? Fine. One subcontractor in southwestern Ohio, aided by Firestone expediters, has accomplished a remarkable job. He succeeded in blending the efforts of many small shops, garages, etc., into a workable production unit. Expediters played a major part in this activity, mainly by scouring the immediate countryside for each and every machine tool available, for welding machines, and for other necessary production equipment. The result is that, without additional equipment or dislocation of employees, the job is being done.

Again, on one occasion the Firestone anti-aircraft assembly line was threatened with the possibility of a shutdown because of changes in design and materials shortages. So a

SPEED UP AND SAVE••



WITH VACUUM CLEANING ON EVERY FLOOR . . .

IT CLEANS
FLOORS
LEDGES
MACHINERY
PIPES
WALLS

IT RECLAIMS
CHEMICALS
FUEL
METALS
RUBBER
SAND

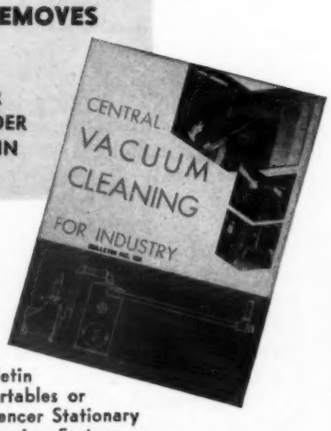
IT REMOVES
GRIT
LINT
PAPER
POWDER
VERMIN

When a plant is laid out for modern stream-line production, conveyors play an important part in the rapidly moving production line. The greater the output, the greater the need for removing excess materials and for keeping the plant clean from top to bottom.

Why not put dirt, dust and debris on a conveyor too?—the vacuum "down and out" method shown above—a straight line ***down*** to the basement, and then ***out*** of the plant for good.

With Spencer Vacuum Cleaning, you can remove heavy debris during working hours, clean huge areas quickly; and take dust out of machines, off from walls, ceilings, pipes and the goods in process or in storage. You save on man-power, too, and reduce health, fire and explosion hazards in every room.

Spencer's are going into new defense plants every day, and it's never too late to install the Spencer Vacuum Cleaning System in your present plant. A few vertical risers with convenient vacuum inlets, an assortment of tools, and one or two men will do the rest for years to come.



Ask for Bulletin
102F on Portables or
125F on Spencer Stationary
Vacuum Cleaning Systems

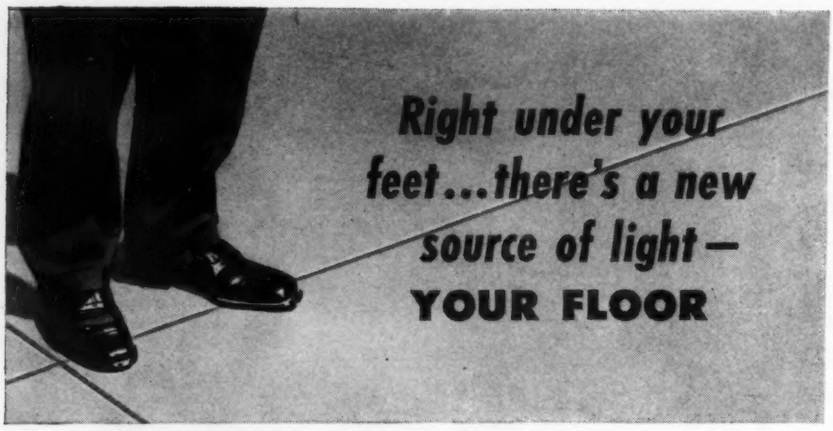
SPENCER VACUUM

Portable Cleaners ¾ to 7½ H.P.; Stationary Systems up to 100 H.P.

THE SPENCER TURBINE COMPANY

HARTFORD, CONNECTICUT

S-2288



WAR PRODUCTION SPEEDED BY GIANT NEW LIGHT REFLECTOR

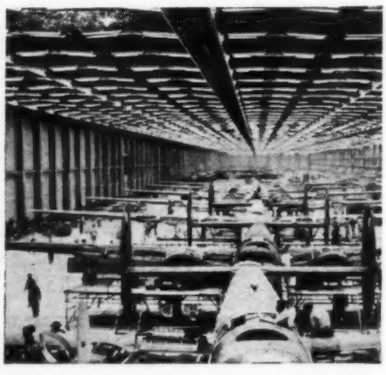
Floor that reflects light increases efficiency and reduces accidents

LIGHT-REFLECTING FLOORS, made with Atlas White Cement, are acting today as giant reflectors and diffusers of light in essential war plants. They chase shadows from production and assembly lines. They reflect much more light to the under side and vertical faces of work. They help employees operate with greater speed and safety...avoid errors and spoilage of materials. They sharpen the vision of workers who have defective sight ... of older men and of new workers who are working at a machine for the first time.

White-cement floors in aircraft plants for Boeing, Consolidated, Douglas and North American are showing their superiority over darker floors. Look into them, either for new buildings or as re-topping for old floors. In installations already made they have repaid their initial cost quickly. They can be cleaned and kept white simply and economically.

In factories, food plants, warehouses, hangars, hospitals, offices, apartments—in corridors, basements, stairwells—wherever increased production, material conservation, extra lighting, sanitation and safety are important, it will pay to get LIGHT FROM FLOORS.

Write for a new book, "LIGHT FROM FLOORS." It tells about the advantages of better illumination and gives detailed information on the construction, maintenance and value of light-reflecting floors made with Atlas White cement. Universal Atlas Cement Company (United States Steel Corporation subsidiary), Chrysler Building, New York City.



White cement floors on which Consolidated Aircraft Corporation is assembling B-24 bombers. The white cement surface throws 61% more light to the under side of bomber wings and fuselages, and 20% more light on vertical surfaces than does grey cement surface in adjacent areas in same plant. Designed and built by The Austin Company.

OFFICES: New York, Chicago, Philadelphia, Boston, Albany, Pittsburgh, Cleveland, Minneapolis, Duluth, St. Louis, Kansas City, Des Moines, Birmingham, Waco.

IF YOUR FLOORS ARE WHITE, YOUR PLANT GETS MORE LIGHT

F-F-4

LIGHT-REFLECTING FLOORS
MADE WITH ATLAS WHITE CEMENT

Firestone expediter left the home plant late one evening and, after covering a few hundred miles in the next couple of days, managed to scrape up enough material and finished parts to keep things rolling until the regular subcontractor could tool up to do the job.

I Saw Inflation on the Ruhr

(*Continued from page 91*)

"But our hunger," observed an old veteran, "only proves, I believe, that our good old German God has found us his people here too prideful. He's trying to teach us the everlasting necessity of a humble and a contrite heart."

"A Christian Socialist," whispered a friend at my elbow.

"If you ask me," broke in a young man as he banged his lamp on the floor, "your good God is too busy with his angels up there in your silly heaven to bother about your empty stomach and mine. It's for us here with our hands to take our hateful capitalists—including our own prince of capitalists, Stinnes—and drown them all in the North Sea. Then we can start eating again."

"*Ein Kommunist*," explained my companion.

It's a cinch that above ground he and his fellow Reds were making good use of their observation that Bolshevism is less a matter of head and heart than of stomach and so were signing up new members after every one of the district's frequent hunger riots. These usually started with an angry crowd outside some grocer's window and ended with a mess of broken glass, a quick gorge for a lucky few, and for others a fatal case of lead poisoning at the hands of the local police. It was therefore no mere happenstance that made the Ruhr, a few years later, the scene of the Red Kapp's rebellion or that throughout the country the Bolsheviks increased their number so steadily that Hitler could secure money from Thyssen and others of the Ruhr's rich industrialists by posing as the savior of German capitalism.

It is because any breakdown of faith in the realm of bread, potatoes, and coal so quickly becomes a matter of morals and politics that a prominent American banker—observer in the Ruhr of '23 said to me:

"If I wanted utterly to demoralize a nation—to destroy it in both body

Now You Can Utilize the New Dy-Namic Balancing Technique to Eliminate Excessive Vibration . . Noise . . Wear!

For as little as **$295 BUYS A**

BEAR DY-NAMIC BALANCING MACHINE

Most shopmen can learn to operate these Machines in less than 2 hours!

Prompt Deliveries can be made to those with war industry priorities!

Dy-Namic Balancing . . . hailed as one of the big post-war developments is here today . . . ready to perform a BIG PART in helping American Industry win the war. Through Dy-Namic Balancing of rotating bodies, greater efficiency . . . smoother and quieter operation . . . and reduction of wear are obtained.

Manufacturers will use Dy-Namic Balancing both for the rotating parts of the products they manufacture and, also, to improve their own production machines and operating equipment . . . to balance motor armatures for example, so that both motor and lathes will run smoother . . . to balance fans to cut down bearing wear and noise . . . to balance armatures, grinding wheels, fly wheels, etc., etc., for more efficient operation.

Equipment repair and maintenance concerns will make Dy-Namic balancing an essential step in their operations of repairing and rebuilding equipment.

Couple Action caused by static and Dy-Namic unbalance of rotating bodies sets up excessive vibration which results in premature failure of machines and equipment. (A one inch ounce of unbalance becomes a force of over 1 lb. at 800 RPM; two lbs. at 1050 RPM; 45 lbs. at 5000 RPM.) Up to now, the elimination of couple action by proper static and Dy-Namic balancing has been a costly and tedious process. This is no longer true because with the Bear Balancing Machine it now can be done QUICKLY, SIMPLY and INEXPENSIVELY.

Already many Bear Dy-Namic Balancing machines are in successful use in Industry. "These machines," report users, "are extremely sensitive and accurate. They provide Dy-Namic and static balancing in one continuous operation that meets all established requirements including government specifications for balance. And they are a thousand times simpler to operate."

Bear Dy-Namic Balancing Machines are made in many sizes and types, ranging from bench models for light work to large heavy-duty floor and pit machines.

Engineering Counsel is at your service. Write, wire or phone details of your problem or write for the **free catalog** containing data on Dy-Namic Balancing. Address Bear Mfg. Co., Dept. F, Industrial Division, Rock Island, Ill.

If your product has rotating parts . . . Investigate Bear Balancing

THROW YOUR SCRAP INTO THE FIGHT!

FEDERAL

THE NEW FEDERAL CATALOG

— just off the press!

. . . and it's yours for the asking.

This new 68 page, illustrated 2-color catalog is designed to provide a quick, ready reference to help you in the selection of the proper switch or panelboard or circuit breaker for every use.

You will find it a valuable source book. For it contains a complete listing of specifications and list prices of the Federal line *plus* a wealth of useful additional information—Allowable Increased Horsepower Rating, Number of Conductors in Conduit, Wiring Data for Motors. And you will find in it a simplified numerical cross-index to make comparisons easy.

Write for your copy now! You're sure to find it a handy, time-saving aid.

FEDERAL ELECTRIC PRODUCTS COMPANY
58 PARIS STREET • NEWARK, N. J.

PANELBOARDS • SAFETY SWITCHES
SWITCHBOARDS • CIRCUIT BREAKERS

and soul—all I'd bother to do would be to give it a good hard dose of inflation."

But, if this disease has such dreadful final possibilities, why is it so seldom checked in its earlier and milder stages?

Slow at First

The biggest reason is that, whereas at first the race between prices and pay checks is too slow to appear significant, the moment its tempo arouses serious fear, its slowing down becomes all but impossible. For at that same moment the race looks like the same elevator to Utopia that we all found so delightful in early '29. With the exception of those unorganized and therefore politically insignificant people who live on fixed incomes, everybody is reveling in the handling of more dollars, feeling richer than ever. Inventories and farm lands are showing beautiful gains. Labor leaders are demonstrating their ability to get increases, and therefore finding new members and dues collections easier than ever.

This, of course, is the time to stop. But who's going to say the word? The labor leader? The farm bloc? The government? The man who says it is sure to be called the enemy of Utopia, a traitor to his group. To say it is just as easy as for any leader —of farmers, wage earners, or voters —to stick his neck out and lay it neatly 'neath the guillotine.

Failure to Understand

That guillotine's knife edge is furnished by the farmer-voter's failure to understand that the prices he gets have no meaning apart from the prices he must pay, and by the worker-voter's refusal to believe that the raises given him by the War Labor Board mean nothing apart from the decisions of the Office of Price Administration. It was this same misunderstanding that made my fellow miners in the Ruhr ask me every day:

"Why does your damned American dollar insist on always getting dearer and making our marks here buy daily less and less?"

"Those poor Britishers," exclaimed similarly the French worker when, at another period, his coins furnished him a constantly smaller loaf of bread, "every week they have to pay more and more of our good francs for their pound sterling."

In the Ruhr the wise builder of a home secured from the Coal Operators Association money with which to erect it upon four jacks. Then, if excavations underground later caused the southeast corner of his house to sag, he merely gave that corner's jack

LISTED BY UNDERWRITERS' LABORATORIES, INC.

a motor for use in ...

MAGNESIUM DUST

Also ALUMINUM and other combustible metal dusts

HERE'S a motor specifically approved for service in the presence of magnesium dust (the metal of which incendiaries are made), as well as in aluminum powder and other combustible metal dusts. It fills a critical need of metal-working and ordnance plants, wherever combustible metals are being handled in powder form, and where machining, grinding, or polishing operations are being performed. It's another FIRST among G-E motors for hazardous locations.

Tests of this new totally enclosed motor at Underwriters' Laboratories, Inc., have demonstrated its ability to meet hazards included in Class II, Group E, of the National Electrical Code. For full information, write Motor Division, General Electric, Schenectady, N. Y.

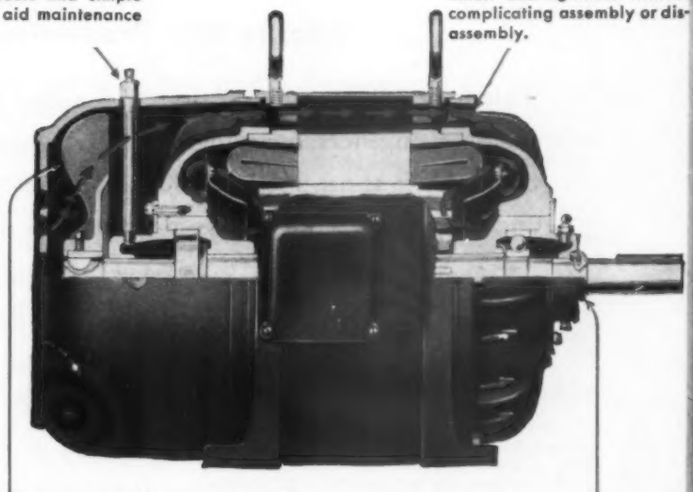
METAL DUST . . . ACETONE . . . TOLUOL . . . GASOLINE . . . COAL DUST . . . GRAIN DUST . . . Name your hazard—this family can meet it.

No single enclosed or explosion-proof motor is recommended for all types of hazardous service. General Electric has pioneered in producing a family of motors to meet the dangers of specific gases, vapors, liquids, and dusts. Our engineering staff can help you pick the right motor, and advise on the use of overload relays and other installation factors for full-scale protection.

Typical Class II, Group E, motor now available in sizes up to 125 hp

Pressure-relief lubrication, smooth contours and simple construction aid maintenance

Tight joints, accurate fits mean dust-tightness without complicating assembly or disassembly.



Effective cooling is obtained even under a blanket of dust

Labyrinth seal and complete cast-iron bearing enclosure exclude dust for continuous operation

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment.

BUILDER OF TRI/CLAD MOTORS

REG. U.S. PAT. OFF.

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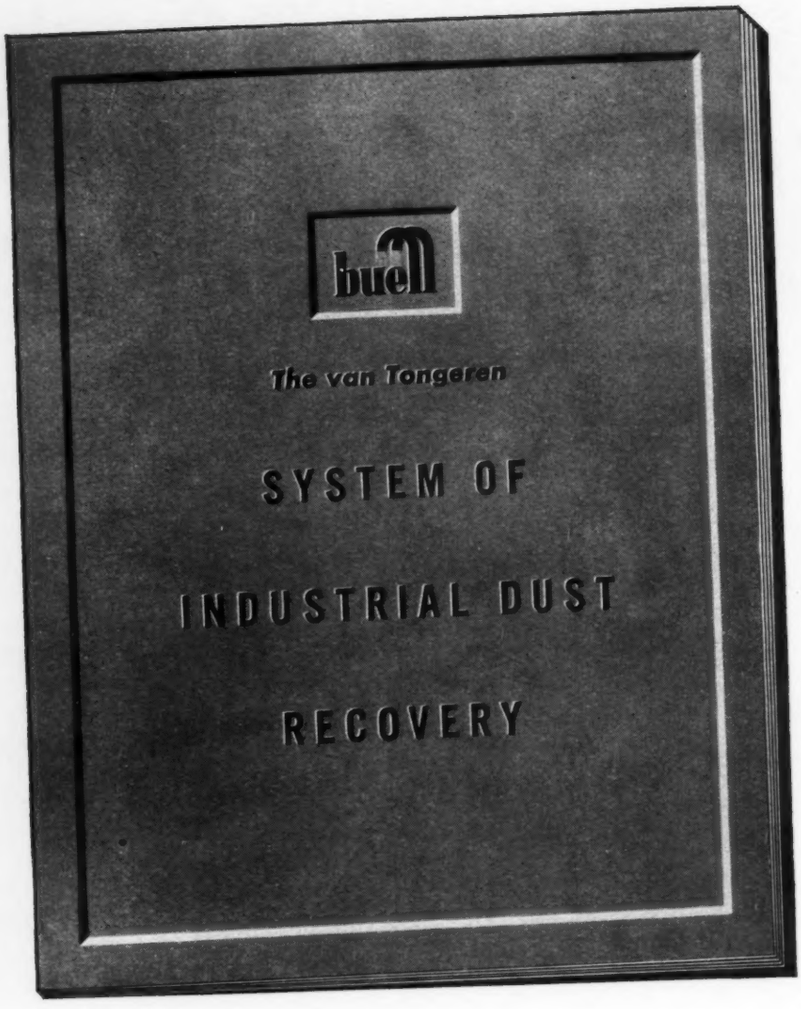

A NEW BOOK ON DUST CONTROL

Vital to War Production

This new, 28-page book, prepared under the direction of the Buell engineering staff, discusses the importance of dust control in war production; and contains much authoritative and helpful material on the problems of dust in industry.

Of particular interest are specific examples of the wide use of Buell (van Tongeren) Dust Recovery Systems throughout industry. A copy of this book will be sent to any executive or engineer requesting it. ***Ask for Bulletin FA-10.***

BUELL ENGINEERING COMPANY, Inc.
12 Cedar Street, New York
Sales Representatives in Principal Cities

CONSULT BUELL *First* IN DUST RECOVERY
for Chemical • Rock Product • Metallic • Food • Flue or any other dusts

buell
DUST RECOVERY SYSTEMS

a few turns and proceeded to live again on the level. When the sag was noticeable at only one or perhaps two corners at a time, his jacks protected him. But when at one and the same moment all four corners demanded quick attention, they were powerless to save him from the suddenly yawning abyss.

No One Knows

Among us here today nobody dares predict how far our present incipient spiral may conceivably carry us in the direction of that final demoralization which Germany, even with the help of the French Occupation and other international complications, took ten long years to develop. But already it is plain enough that here and now we are witnessing not so much the attempt to halt the spiral as what can be called the "battle of the jacks."

At the wage corner of our economic house stands a powerful and expert jackturner confidently insisting that "labor will unalterably and uncompromisingly oppose any attempt to destroy its economic freedom under the pretext of preventing inflation." He disposes of inflation as nothing but a "thesis compounded of conjectures and prophecies, fears and hysteria."

Maybe he's right in feeling so sure that with a few turns he can at one and the same time offset any rise in prices and also strengthen his organization. But the trouble—for him and for all of us—is that at the opposite corner stands another equally powerful jack expert whose feet are braced on the platform of farm price parity. Also at the other corners and in-between stand numberless suppliers of others needed commodities. To all of them access to the jack of price spells protection against the jack of wages.

But they all do possess an additional means of self-preservation—they can strike—refuse to sell, just happen to be "fresh out" of potatoes, bread, coal, or what not. Furthermore, such a strike brings to them less risk of hunger than it does to the wage earner. It is because the policing of the price jacks is always more difficult than that of the wage jacks that the wage wing of inflation's spiral almost invariably lags behind the price wing.

Call Off the Battle

Meanwhile, of course, the country's political leaders have it in their power to keep our economic house in equilibrium by calling off the battle of the jacks before breakdown in potatoes, bread, and coal threatens not only the worker's shirt and pants but

"Have you got any of these Headaches?

Are you up to your neck in PAPER WORK?

Do your PRODUCTION CONTROLS give you the green light—or bind you in red tape?

Are you wasting time and multiplying errors by writing production orders, move orders and shipping orders *separately*—when ONE WRITING CAN DO IT ALL?

Is CLERICAL WORK in the shipping department causing delays?

Are MATERIALS BOTTLENECKED in Receiving and Stores?

Do CLERICAL ROUTINES get in the way of production?

So did I—'til I put them up to STANDARD!"

ARE you tolerating *any* of the headaches and delays that simple, adequate controls can cure? Then call in the Standard Man and learn how hundreds of war industries—with problems just like yours—have streamlined their production controls, simplified their paper work, cut waste, delays and red tape to a minimum.

Standard offers a better and faster way of writing plant records. At ONE writing you make the original record and multiple copies for different departments. You cut out waste motion and get accuracy. No re-copying—you get positive control with dependable records—plus production speed from purchasing through shipping. You simplify paper work and give war production the green light.

THE STANDARD MAN CAN HELP INCREASE YOUR WAR PRODUCTION

He deals in facts and figures. For busy men he has a sound film, "Everything Under Control," which shows you how others have solved similar problems by streamlining paper work. He is backed by an organization of more than 1000 people whose daily job it is to help industry *speed up* war production through the use of simple, adequate controls.

BUT GET THE STORY FIRST HAND! Write today.

Standard—originator of the distinctive forms identified by the marginal punched holes—offers a better, faster way of writing records. Only Standard has developed pin-feeding devices for positive control of continuous business forms for all types of systems and for use in typewriters, autographic registers and practically all business machines.

THE STANDARD REGISTER COMPANY
DAYTON, OHIO

Pacific Coast: Sunset McKee-Standard Register Sales Co., Oakland, California. *Canada:* Crain Printers, Ltd., Ottawa, Ont. *Great Britain:* W. H. Smith & Sons, Ltd., London.

Standard Systems
of Industrial Control

"The Forms With the Punch"

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2 GRIPS ARE BETTER THAN One

Saves MONEY TIME HOSE

HANSEN

PUSH-TITE Compression Type HOSE CLAMP SOCKETS

Hansen compression type hose clamp sockets are different in more ways than one. They hold much better because unlike ordinary hose clamp sockets they grip on the inside as well as the outside of hose —two grips instead of one. It's a "compression grip" which means no tearing or ripping of hose. Hansen Compression Type hose clamp sockets are extremely easy to install, merely screw stem into hose, takes but a minute. Prolongs the life of hose by supporting hose at connection, preventing breaking and cracking. Economical too because they can be used many times over.

Send for free catalog on complete industrial air line equipment.

Hansen MFG. CO.
INDUSTRIAL Air Line EQUIPMENT
1786 EAST 27TH STREET • • • • CLEVELAND, OHIO

also a general breakdown in expectation, morals, and government.

The reason why the situation is now dangerous is that its cure requires of these political leaders the use of what to them must at all times be the costliest of commodities—namely, guts.

Meanwhile, according to the economists, the best that all the rest of us can do is to *buy War Bonds.*

How We Retrained 900 Men Every 60 Days

(*Continued from page 96*)

of time and accuracy. This plate involved three separate parts and a final assembly. Only the assembly specifications are shown in the exhibit on page 96. This problem ordinarily required 24 hours. When completed and accepted by his instructors, the trainee was then ready for the specific job training course.

The vestibule school was divided into sections of increasing difficulty corresponding to stages on the way to the completed job training. The first two or three rows of benches had a vise on each bench; it was here that the test plate, drilling, and open riveting were taught. The next section contained benches for semi-blind riveting; the next for blind riveting. Succeeding sections of the school floor contained regular production fixtures for spars, wing tips, and other parts; trainees were assigned to them after the riveting and drilling in order to maintain balanced groups when transferred to the production floor.

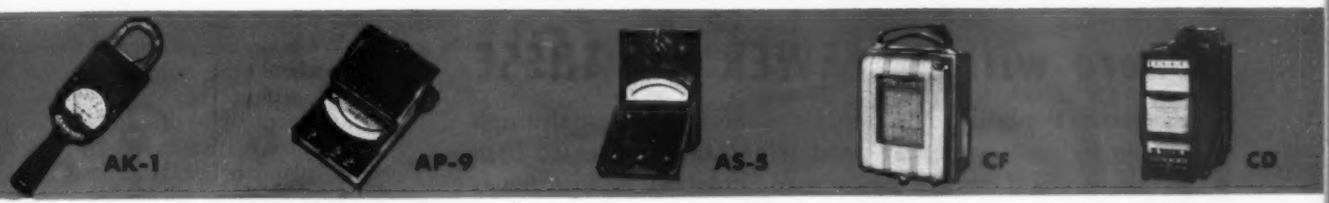
Final Assembly Fixtures

Fixtures for the final assembly of a complicated wing completed the training sections of the school floor. Perhaps it should be reiterated that the generalized part of this sequence required from three to four weeks; after completing the blind riveting stage, which all had to cover, the trainee was assigned to a definite production fixture—the job he was to do on the production floor.

Parts of the production fixtures used in training were numbered to eliminate fitting. Holes were colored in drill fixtures to indicate size, and the corresponding drill was dipped in the same color. These were devices to speed up the work.

One hour of classroom work out of each shift of eight hours was used by the engineer member of the two-man instructor team to instruct his group in blueprint reading, trade

Which OF THESE HANDY INSTRUMENTS DO YOU LACK?



Type AK-1 Hook-on Volt-ammeter (A-C) Here's the handiest type of instrument for quick load checks. Forget about cutting conductors or interrupting service. Just hook it around the line, flick the selector switch to AMPERES, and you have your measurement. It measures volts also—connect the voltage leads, snap the switch to VOLTS, and take your reading. Accuracy, ±3 per cent. (Bulletin GEA-2950.)

Type AP-9, Medium-size A-C Portables—and Type DP-9, D-C You'll want this instrument for jobs requiring a high degree of accuracy—it's accurate within ¾ of one per cent. It is very portable—size only 2½ by 6½ by 4¾ inches. Available in a-c ammeters, voltmeters, milliammeters, and wattmeters; and d-c ammeters, voltmeters, milliammeters, microammeters, and millivoltmeters. (Bulletin GEA-1784.)

Type AS-5, Pocket-size A-C Portables—and Type DS-5, D-C This one fits easily in a coat pocket (size, 2 by 3½ by 5½ inches), yet it is accurate within one per cent. Available in a-c ammeters voltmeters, and milliammeters; and d-c ammeters, voltmeters, milliammeters, microammeters, and millivoltmeters. (Bulletin GEA-1784.)

Type CF, Inkless Recorders (Portable) Often, a chart record of load or voltage conditions over a period of time is needed to study the duration of peaks and the time when they occur. The CF line is ideal for this purpose. They're *inkless*—ready to go at a moment's notice—no pen to start, no inkwell to fill, and no ink to spill and blur the record. They weigh only 12 pounds. They are very accurate—a-c voltmeters, within 1½ per cent; ammeters, within 2 per cent. Available in a-c ammeters and voltmeters; and d-c ammeters, voltmeters, milliammeters, microammeters, and millivoltmeters. (Bulletin GEA-3187.)

New Low Chart Speed You can now get a 30-day record on a 30-inch chart—with our new one-inch-per-day chart speed. This simplifies survey analysis. Speeds of 1, 2, and 3 inches per hour can be obtained for applications requiring a higher chart speed.

Type CD, Ink Recorders (Portable and Switchboard Types) These recorders are ideal for those applications where a high degree of accuracy is very important. Either ink type or inkless. They are available in a-c ammeters, voltmeters, wattmeters, power-factor meters, and frequency meters; and in d-c ammeters, voltmeters, milliammeters, millivoltmeters, and wattmeters. (Bulletin GEA-1061.)

Current-measuring Sets (A-C) Any of the above ammeters can be supplied equipped with a split-core current transformer—the AK-1 has the transformer built in. Thus you can obtain the "hook-on" advantages in these other instruments, too, for load measurements.

These are but a few of the many instruments General Electric can furnish to measure any electrical quantity. If you want information about other instruments, we'll be glad to supply it. Ask the nearest G-E office, or write to General Electric Company, Schenectady, N. Y.

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in five plants manufacturing naval equipment.

HEADQUARTERS FOR ELECTRICAL MEASUREMENT

GENERAL ELECTRIC

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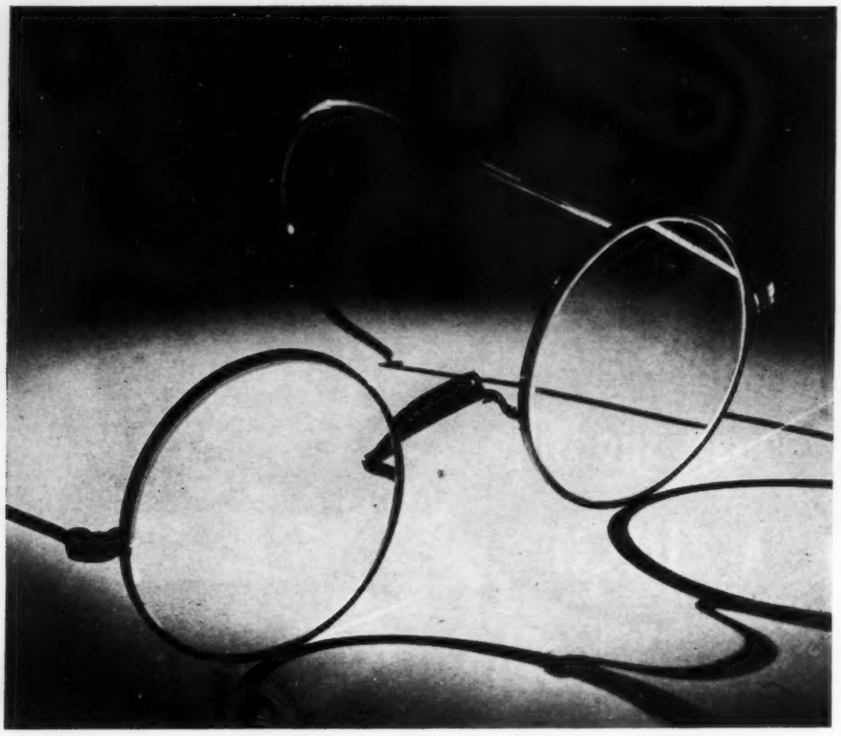


There will be FEWER OF THESE

Eyeglasses symbolize eyestrain. By reducing eyestrain through proper lighting, your war production can be increased both in quantity and quality. Fewer man-hours will be lost, fewer rejects will come off your production lines.

Silv-A-King offers a complete lighting service—fine equipment (either fluorescent or incandescent) plus skillful engineering to lay out your lighting installation for maximum effectiveness. Our ability to serve you well in lighting comes from 21 years of experience as industrial lighting specialists. A Silv-A-King lighting engineer is at your call wherever you are located.

Bright Light Reflector Company, Inc.,
1027 Metropolitan Avenue, Brooklyn, N. Y.

Write for new, 16-page Silv-A-King book:
"Light Is An Essential Production Tool"

A Few Typical Silv-A-King Users:
AC SPARK PLUG
GENERAL MOTORS
FISHER BODY
INTERNATIONAL HARVESTER
JONES & LAUGHLIN STEEL
PITTSBURGH PLATE GLASS
and many others

FLUORESCENT · INCANDESCENT
SILV-A-KING
EQUIPMENT

SILV-A-KING MAKES *Light* WORK FOR YOU

terms, heat treating, alloys, and other technical aspects to be met on the production floor.

The two-man team of instructors, in addition to giving the trainees a balanced ration of technical and practical instruction, was in position to give detailed individual attention to every trainee, for each team danced constant attention upon 30 men from the time the shift began till it ended —a most important ingredient in a program of this sort. A word about the ages of the trainees—men from 18 to 60 were working side by side.

Four hundred hours have been mentioned as the required period of training. The time, however, was not fixed. That it was not, scores an important point for the individualized supervision of the two-man instructor team, for each trainee was moved along just as fast as it was evident to the instructors that he was prepared to go. One worker might get to the production fixtures, the final stage in the vestibule school, in three weeks; another worker required seven and a half weeks. These are actual, and typical, cases.

While on the production fixtures in the school, the trainee followed the job specifications, or analyses, originally prepared by his instructors, for the instructor was trained to teach a particular job just as the worker was trained to do a particular job.

Visual forms of education were also used. When the program was in the organization stages, a series of slide films and motion pictures, both in sound, were developed to demonstrate in a dramatic way many of the most important features of aircraft production to be met in the shop.

The foremen were consulted as to their problems, and eight topics selected which dealt with drilling, riveting, materials handling, and quality control. A fictitious character, Danny Defense, was used to carry the thread of the message. In the materials handling film, for example, Danny worked through many and varied experiences with the Demon Waste to point out the need to (1) reduce the amount of handling, (2) keep stored material out of the working area, and (3) protect the material when it must be handled.

Each trainee was required to attend the showing of each of these eight films. In addition, a booklet based on each slide film and movie was given to each worker. It was found that the interest stimulated by the films, and the opportunity presented by the booklet to review the subjects presented, resulted in a better and a more rapid grasp of important details of the job than could have been had without them.

HERE IS INDUSTRY'S ANSWER — TO THE *Gilmer* NATIONAL POWER-RECOVERY PLAN

"To say the least, the program which your Company has inaugurated towards the objective of conserving power in industry is intriguing and most timely."
Motor Div., General Electric Company

I USE WHAT YOU LOSE

"We extend our congratulations on your National Power-Recovery Plan which is so well explained in the booklet."
Johnson & Johnson

" want to congratulate you upon your 'National Power-Recovery Plan' and its method of presentation "
Leeds & Northrup Company

Typifying the reaction to the Gilmer National Power-Recovery Plan, the above comments give positive proof that Industry is awake to the danger of a power shortage, and recognizes the Plan as a practical stitch-in-time.

Approved by the WPB, the Power-Recovery Plan is offered absolutely free to industry, as Gilmer's contribution to the war effort. The "know-how" of leading power engineers has been incorporated in the Plan, and you'll find a wealth of technical information on each of the power services—Electricity, Steam, Mechanical Transmission, Compressed Air, Water, Refrigeration, Boilers, Prime Movers.

Enlist YOUR plant in this vital battle against power waste. And don't wait until power runs short . . . act NOW. Just send in the coupon, and the Plan will come to you promptly . . . all contained in one convenient booklet.

L. H. GILMER CO., Tacony, Philadelphia, Pa.

Gentlemen:

Please send us, without cost or obligation, a copy of the National Power-Recovery Plan, marked for the attention of:

NAME_____

FIRM_____

ADDRESS_____

Gilmer BELTS

L. H. GILMER COMPANY TACONY, PHILADELPHIA, PA.
The Oldest Firm of Rubber-Fabric Belt Specialists

DARNELL

Casters & Wheels

SAVE EQUIPMENT . . .

Floor wear is reduced to a minimum—costly floor replacements and repairing practically eliminated.

SAVE FLOORS . . .

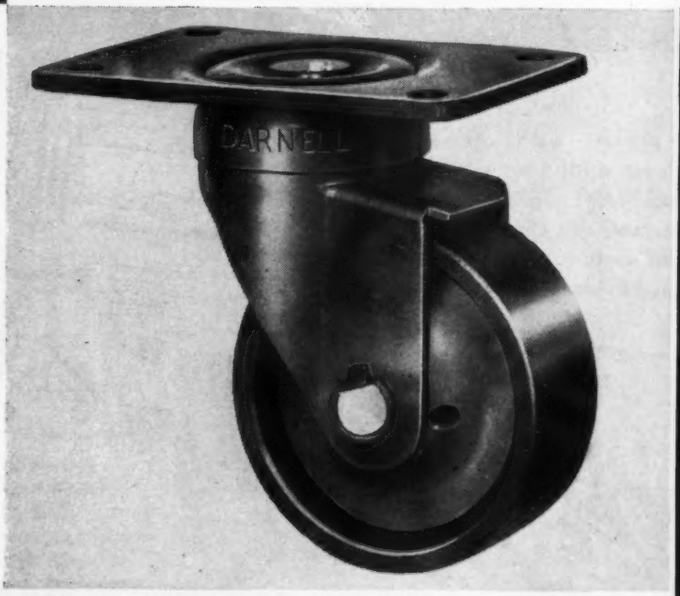
No wracking of equipment due to stubborn, hard-to-roll casters. Darnell Casters "always swivel and roll."

SAVE TIME . . . . .

Speed up inter-departmental movement of products and materials . . . increase efficiency of employees.

FREE

. . . Write for new 192-page Caster & Wheel Manual.



DARNELL CORP. LTD., 60 WALKER ST., NEW YORK, N.Y.
LONG BEACH, CALIFORNIA, 36 N. CLINTON, CHICAGO, ILL.

How Healthful Is Your Plant

(*Continued from page 102*)

measures may include the segregation or inclosure of a particular process, adequate exhaust ventilation, use of wetting methods, improved housekeeping, personal protective equipment, and, of top importance, competent medical supervision.

But processes change, equipment deteriorates, improvements develop, supervisors and workers get careless. Therefore, a fourth step, *maintenance*, becomes necessary. This means periodic check-ups to insure the "eternal vigilance" that is so essential to safe operation.

Industrial hygiene is concerned with factory *conditions*, with helping a company maintain a healthful working environment. The care of the workers, as individuals, is the responsibility of the physician alone. Findings from an industrial hygiene survey may suggest the advisability of physical examinations, urinalysis, blood tests, X-rays, etc. Industrial Hygiene Foundation, a non-profit, cooperative association of industrial concerns, for the conservation of employee health, recommends that a company's medical director or adviser determine the course of action. No comprehensive survey is possible without medical collaboration and guidance.

Compensation Granted

Twenty-five states and the District of Columbia now grant compensation for occupational diseases. At least 141 bills relating to occupational diseases were introduced in the state legislatures and in Congress during 1941. In one state "poison ivy and oak poison" were added to the list of compensable diseases, indicating the current trends. Periodic industrial hygiene surveys, and the correction of hazards disclosed, help fortify a company against unfounded compensation cases and damage claims. We recently asked member companies these questions:

1. If occupational disease claims were filed against your company tomorrow, would you have dependable evidence showing the conditions to which your employees are exposed and were exposed *at the time* of the alleged injury?

2. Have you had a complete survey made of all operations where there might be potential health hazards?

3. Are checks made periodically to determine if the health protective sys-

IT PAYS TO SPECIFY *Westinghouse Matched Unit Drives*

Westinghouse
MATCHED TO THE JOB
Gearing

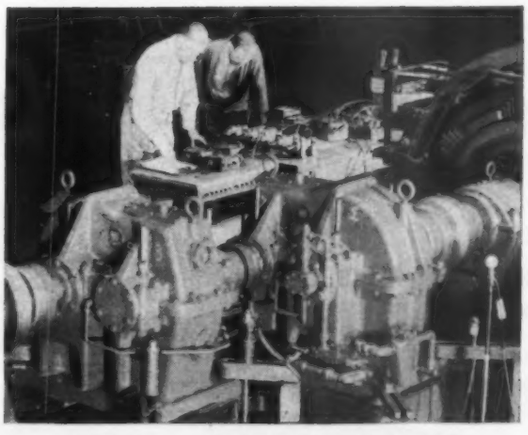
STEPS UP EFFICIENCY AT THE VITAL LINK!

A vital link in any air conditioning system is the gearing between motor and the centrifugal compressor. It must permit each to operate at peak efficiency, deliver maximum power where needed.

In designing and building complete matched unit drives for the country's largest air conditioning installations, Westinghouse has learned a lot about gearing . . . how to make it better, to serve you better. Gear teeth are precision-cut on specially designed hobbing machines for smoother operation. Low unit stresses and an instantly responsive lubricating system assure quiet, efficient operation over a long period of time.

Most important of all, every Westinghouse Speed Increaser is carefully matched to the job . . . is *right* in every respect for both the motor and compressor used. And to be doubly sure on this point, every Westinghouse Matched Unit Drive is given a pre-test at the factory prior to shipment.

Get all the facts on these better Matched Gear Units for centrifugal compressor drives. Write for Bulletin 3044. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.



CHECKED AND DOUBLE CHECKED

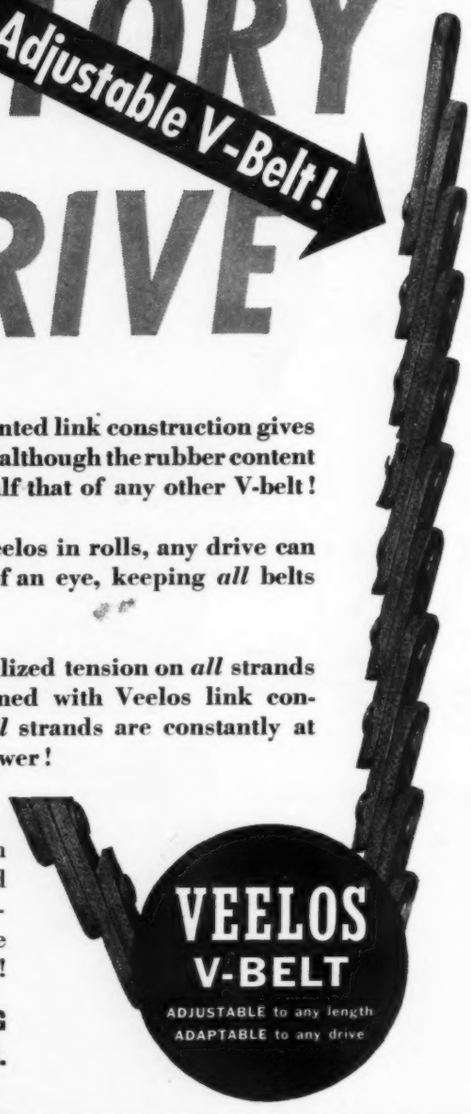
All Westinghouse precision-made gearing undergoes exhaustive tests at the factory. This is an extra safeguard and assures outstanding performance on the job.
J-07199

WESTINGHOUSE GEARED FOR VICTORY

Westinghouse
GEARED DRIVES

AMERICA'S VICTORY DRIVE

VEELOS... the Adjustable V-Belt!



1 ***SAVES RUBBER!*** **Patented link construction gives Veelos greater flexibility although the rubber content of Veelos is less than half that of any other V-belt!**

2 ***SAVES TIME!*** **With Veelos in rolls, any drive can be replaced in the bat of an eye, keeping *all* belts on the drive!**

3 ***SAVES POWER!*** **Equalized tension on *all* strands can readily be maintained with Veelos link construction. Therefore, *all* strands are constantly at work delivering full power!**

Let a Veelos "Production Warden"— especially trained in power transmission work— study *your* set-up for possible savings of rubber, time, power!

MANHEIM MANUFACTURING & BELTING CO., MANHEIM, PA.

SAVE RUBBER!

OCTOPUS FLAT TRANSMISSION BELTING ends slippage and stretch . . . through greater resilience and more powerful grip. Saves rubber!

In conveyor belting, KEYSTONE CANVAS STITCHED is the answer to the rubber shortage. Can be shipped in a week or less.

tem is being properly operated and maintained?

4. Besides serving as a guide, to protect employee health, are the data in the form of an official record, available as evidence?

The fact that "it never happened before," or the unsupported *belief* that "there are no health risks in our operations," makes poor evidence and a poor substitute for a survey report. A company that does not know its health hazards, or does not know with scientific certainty that its operations are free of hazards, is like a company that does not know its costs.

Who Conducts Surveys

Surveys are conducted by governmental agencies, such as the U. S. Public Health Service, U. S. Bureau of Mines, State Divisions of Industrial Hygiene, many of the insurance carriers, and by private consultants. Industrial Hygiene Foundation conducts such surveys as one of its services for member companies. In the case of the Foundation, and some of the other agencies, the report of the survey findings is strictly confidential and the exclusive property of the management in question.

In this connection, Andrew Fletcher, vice-president of the St. Joseph Lead Company, says:

"I strongly urge that progressive companies currently obtain information as to dust, fumes, etc., under prevailing working conditions. It is even advisable to have these data prepared by a disinterested and recognized authority in the medical or engineering field of industrial health. If the information is secured by the company's own employees, it is often disregarded by compensation commissions or by the courts, as prejudiced, just as is often the case when the data have been obtained after cases have been filed and when it is necessary to prove that the conditions then found were the same as those prevailing before or at the time of alleged accident."

Benefits of Surveys

Surveys help insure maximum manpower, an imperative need today when production means our protection. Plant surveys, plus the keeping of sick absence records, help reduce the severe losses which every company and every workman suffer each year through illness. (Sickness claims an average of 8 days per employee per year, and sick absences alone cost a company an estimated $60 annually for each employee.)

Surveys help improve labor relations. The notion that such investigations may excite workers, "stir something up," has been refuted by actual experi-

TAKE FRICTION OUT OF YOUR PLANT

SAVE MACHINES

PRESSED STEEL COMPANY: "On our 30 Toledo Presses, we have been using LUBRIPLATE Nos. 70, 105 and 130-A with outstanding success for several years. Our parts replacement expense during the past year on our presses was nil, which we entirely attribute to the use of LUBRIPLATE."

SAVE TIME

AIR TRANSPORT LINE: "We have very successfully used LUBRIPLATE No. 130-A in assembly of airplane parts. Its use not only facilitates our assembling work, but also affords protection against rust and corrosion."

SAVE COST

TOOL STEEL MANUFACTURER: "We find that since adopting LUBRIPLATE No. 4 about three years ago for use in all of our electric motor bearings, that consumption of lubricant has been reduced 90 per cent, temperature of motor bearings has decreased as much as 40 degrees F.—and consequently, maintenance costs have been lower."

SAVE WORRY

BLOWER MANUFACTURER: "Since adopting Ball Bearing LUBRIPLATE several years ago, our ball bearing replacement expense has been reduced upwards of 50%."

7 FACTS ABOUT LUBRIPLATE

1. *LUBRIPLATE produces an ultra-smooth, wear-resisting bearing surface.* 2. *LUBRIPLATE reduces friction, thus lowering maintenance and power costs.* 3. *LUBRIPLATE resists rust, corrosion and pitting.* 4. *Most LUBRIPLATE products are white. LUBRIPLATE assures clean lubrication.* 5. *LUBRIPLATE outlasts ordinary lubricants many times.* 6. *LUBRIPLATE is economical—a little goes a long way.* 7. *LUBRIPLATE is available in fluid and grease types for every need.*

DON'T let friction get in and sabotage your precious production machines that are so badly needed these days. Scored, damaged or burned-out bearings, costly repairs, idle machinery waiting for repair parts must have no part in today's vital need of more and more production.

Proper lubrication will keep this vandal "friction" out of your plant . . . lubrication that provides a tough load-bearing, long lasting film between all shafts and bearings, gears, chains and other contacting machine parts. LUBRIPLATE lubricants will do it. LUBRIPLATE is in a class by itself. It possesses properties not found in conventional lubricants.

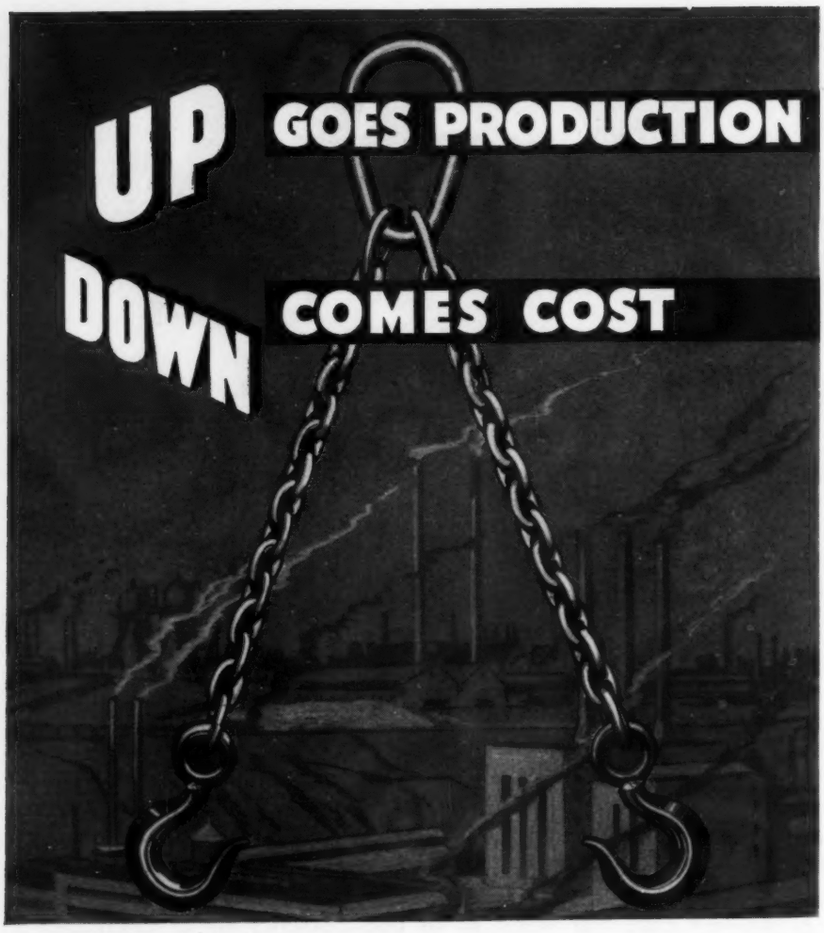
Don't take our word as to the efficiency of LUBRIPLATE. Read this letter from one of the best known manufacturers of metal products in this country:

> "As you know, our machinery is of the high speed type, and with the constant increasing of the speed of these machines, lubrication has presented itself to be one of our biggest problems to solve before we can increase speed to a much greater extent. The results of our experience with LUBRIPLATE have been very gratifying as it has caused our machines to run much cooler, and the fact that LUBRIPLATE stays put and lasts longer, it has minimized our lubricating costs. LUBRIPLATE has done all you have claimed it to do."

With such conclusive evidence, don't you think it's your patriotic duty to investigate LUBRIPLATE? Our staff of engineers and dealers everywhere are at your service. Write, phone or wire today.

LUBRIPLATE DIVISION
FISKE BROTHERS REFINING COMPANY
SINCE 1870
NEWARK, N. J. TOLEDO, O.
DEALERS FROM COAST TO COAST

LUBRIPLATE
ARRESTS PROGRESSIVE WEAR



HERC-ALLOY SLING CHAINS

double STRENGTH SERVICE SAFETY

Smooth movement of materials through manufacturing departments means more profits. Herc-Alloy Sling Chains, America's FIRST alloy sling chains, are facilitating speedy production, safeguarding men and materials, and reducing costs in every type of industry.

Fabricated from a high-grade alloy steel of nickel and molybdenum, Herc-Alloy Sling Chains have the endurance and stamina to withstand the toughest industrial assignments. Heat treating under rigid pyrometer control insures uniformity and ductility. Herc-Alloy Sling Chains never crystallize or develop grain growth ... therefore, they NEVER require annealing. Links are electric welded by the patented "Inswell" process providing 25% more metal at the critical point in the link ... at the weld. For double strength, service and safety, plus cost-cutting performance, specify Herc-Alloy Sling Chains.

CM manufactures a complete line of chain for every application. Trained engineers are available for consultation on your chain problems. Write for Herc-Alloy catalog today.

COLUMBUS-McKINNON *Chain* CORPORATION

(Affiliated with Chisholm-Moore Hoist Corporation)

130 FREMONT AVE. TONAWANDA, N. Y.

Branch Offices: NEW YORK • CHICAGO • CLEVELAND

ence. If properly conducted, surveys have just the opposite effect. They tend to dispel baseless fears by employees that their health is endangered. Some companies have asked for surveys because their workers requested the check-up. Other firms have posted survey findings on plant bulletin boards to reassure their men and to explode false rumors. Workmen are increasingly concerned about occupational health. Witness the increased attention to the subject in union contracts. The frank approach has proved the most advantageous and intelligent policy. Healthful working conditions, like plant safety, can never be fully achieved without the active cooperation of the workmen themselves.

I'd Like the Night Shift, If . . .

(*Continued from page 105*)

But first management must believe in such a possibility and then cooperate with its own program to the fullest extent. The management has to stop thinking of the night shift as a "dead shift."

In my own business I frequently worked late at night, sometimes into the morning. When I had people helping me, I felt that it was up to me to keep the work pace from slowing down. I felt that it was not enough to pay extra for night work, so I would have hot coffee and sandwiches brought in. I kept the radio going and did everything I could to make night work attractive. And when I did my part they did theirs and made it possible for me to meet emergency work schedules. I don't suggest that such a personal approach is possible for a large company. But if large companies want maximum production from the night shift, they must do something more than pay for night work.

A Design for Living

Nobody invented a pattern for day work; it started long ago with the sun. The night worker needs help in working out a new design for living. A simple pamphlet should be distributed, and supervisors should make special efforts to see that it is read, by talking about it and asking questions about it. The pamphlet should directly relate the night worker's work to the war. It should, in simple sentences and with amusing illustrations, describe to the worker how she can plan a schedule to suit her own interests and individual needs that will

THEIR LONGER SERVICE CONSERVES STEEL

AMERICAN PRESSED-STEEL HAND TRUCKS

have rolled Lombard Brothers' freight 10 years without a breakdown

Navy "E" for excellence awarded Feb. 12, 1942.

This AMERICAN Style B has a straight top cross bar, while the three lower bars are curved to accommodate barrels and drums as well as cases and miscellaneous packages.

Steel must be conserved... AMERICAN *Pressed-Steel* HAND TRUCKS are an outstanding example of using steel economically—to get more work done year after year—without repairs or replacements.

For over 10 years, Lombard Brothers, Waterbury, Conn., have been using AMERICAN *Pressed-Steel* HAND TRUCKS in all of their seven busy freight terminals along the eastern seaboard. Handling hundreds of tons of freight every day, with around 50 trucks in use, they have never had a breakdown . . . and their trucks will continue to "deliver the goods" for years to come. Their men say the lightness of AMERICANS makes truckage easier—particularly with the extremely heavy loads handled.

Hundreds of leading operators and manufacturers use AMERICAN *Pressed-Steel* HAND TRUCKS—better built for lifetime service—*better built to deliver more tonnage per pound of steel than any other piece of two-wheeled, materials-handling equipment.*

Buy AMERICANS, cut handling costs, say good-bye to replacements. There is an AMERICAN *Pressed-Steel* HAND TRUCK model for every type of service, a model to meet exactly your requirements.

Send for free Catalog T-42 Today!

The American Pulley Company

4240 WISSAHICKON AVE., PHILADELPHIA, PA.

Helping to Speed Up Wartime Transportation

Power "Scooters" Equipped With General Jumbo Jr. Tires Conserve Energy . . . Save Man Power . . . Step Up Production

SALSBURY SUPER CYCLE

Employees of the Overseas Division of Lockheed Aircraft Corp. are shown here on four of the many Salsbury Corporation (Los Angeles) "Super Cycles" used at this plant. All Salsbury models (single or tandem seats; parcel carriers; side cars for passengers or merchandise) are standard on General Jumbo Jrs.

Other well known "scooter" manufacturers using General Jumbo Jrs. include:

Auto Glide	KEEN Power Cycles	POWELL Streamliner	THE TRANSPORTER
The Cushman Motor Works, Lincoln, Nebr.	J. A. Strimple Co. Janesville, Wisc.	Powell Manufacturing Co., Los Angeles, Cal.	Gest Motor Transporter Co., Philadelphia, Pa.

THE "POWER SCOOTER" has demonstrated its worth over a number of years . . . not only as a pleasure vehicle . . . but as the means of carrying messages, completing errands, delivering small merchandise quickly, inexpensively.

Today, the "scooter" has gained new importance as a valuable aid to more and faster war production. Thousands are demonstrating that they can move necessary people and needed materials fast, dependably . . . from factory department to department . . . and factory to factory.

The majority of "scooter" manufacturers long ago standardized on General Jumbo Jr. tires. Actual experience in this strenuous, fast service has proved to them that the Jumbo Jr. pioneer tire-tube-wheel combination has the extra quality and strength that brings *dependable* performance.

General Jumbo Jrs. *stand up* and take it on "scooters" or *any type* of industrial truck operation. The exclusive, patented design of the Jumbo Jr. makes possible a kind of performance equalled by no other industrial pneumatic. Available for war orders and for certain essential industrial uses.

Tires 8" to 24" overall diameter. Load capacity 100 lbs. to 1500 lbs. per tire. 2- 4- 6- and 8-ply with separate tubes and heavy-duty wheels.

For further information, write,

THE GENERAL TIRE & RUBBER COMPANY • AKRON, OHIO

COPYRIGHT 1942, THE GENERAL TIRE & RUBBER CO., AKRON OHIO

GENERAL JUMBO JR. INDUSTRIAL BALLOON TIRES

make it possible for her to work at night and like it. The pamphlet should emphasize the need for a regular schedule of eating, sleeping, working, and recreation, which would have a normal relation to her working hours. The pamphlet should point out that the greatest single cause of accidents is fatigue and should make as many suggestions as possible regarding the recreational activities that are most suitable and easily available for night workers.

Integral Part of War Effort

The night worker must be constantly identified with the night shift and its necessity for war production. It should be emphasized that the war goes on 24 hours a day, seven days a week, and that the production of war materials must supply the war needs. The night worker is essential to the war effort. Give her a good pin to identify her clearly as a night war worker.

The girls around me were terribly impressed, when our company received a communiqué from General Doolittle expressing his appreciation for our products which helped him in his bombing of Tokyo. We need more things like that. Identifying the use of company products in the war cannot be overdone.

Another thing that would be a marvelous boost for the night workers' morale would be military inspections at night. Once when my department was deep in the throes of a 6 a.m. depression, the rumor that some "big shots" were arriving went rippling through the place. It had an electric effect on everyone. We all came to. There was no tiredness apparent anywhere. The "big shots" never appeared. I'm not at all sure they were supposed to. But even the promised visit was effective.

Production Can Be Equal

Workers on the night shift are aware by implication that their production is not up to day standards, and they are aware of the fact that the company doesn't require equivalent production. This need not be so. Once management has educated the night worker and identified her with her job, it should publicize the difference in the production rate between the night shift and day shift. Then it can establish a production goal for the night shift, using the day shift as a standard, and reward the attainment of that goal with publicity and bonuses in war bonds.

Give the night worker a chance and she'll respond. She is the kind of person who is willing to try something new or she wouldn't have taken a night job in the first place.

IS THIS YOUR IDEA OF

PLATE GLASS?

Just something to look through?

That would be a perfectly natural reaction, because probably no other single product has contributed more than glass to the world's comfort and happiness. In addition to its other valuable properties, glass has the great advantage of being transparent . . . a characteristic that is of infinite importance to mankind. Can you imagine what the world would be like without the tremendous benefits of doors, windows and the thousand-and-one other normal uses of glass?

But the tremendous strides of science and research are rapidly completing a thrilling new chapter to the service of this product which has meant so much to the world . . . giving it new and even more useful characteristics which greatly enlarge its utility for mankind.

Today, glass is doing double duty. In the form of bullet-resisting glass, precision glass for instruments, and as safety glass in bent shapes, it is serving our fighting forces on land, on sea, and in the air. At the same time, it is constantly serving business, industry, and the home by replacing other materials which are so essential to the prosecution of the war.

For instance, manufacturers of an ever-increasing variety of products are finding their answer to their priority problems in an ever-widening use of glass. In many instances, Libbey·Owens·Ford Glass not only solves a product problem, but supplies advantages that make that product better, more serviceable and more salable. Some of the services today performed by glass were never dreamed of just a few short years ago.

Perhaps the physical characteristics of the many new types of Libbey·Owens·Ford Glass may open the way to an entirely new use of glass in *your* product. We will welcome the opportunity to explore with you the possibility of continuing your product with glass. Libbey·Owens·Ford Glass Company, 1350-A Nicholas Building, Toledo, Ohio.

LIBBEY·OWENS·FORD
QUALITY *Flat Glass* PRODUCTS

DERMATITIS SABOTAGES PRODUCTION

If Only One in a Thousand Affected

This Means 120,000 Lost Man-Hours

● Uncle Sam, in placing munitions and war materiel orders, specifies that safety measures must be arranged to protect all "behind-the-line" workers—to guard against lost production through needless loss of man-hours of work.

The men, and now the women too, require the best in sanitary washing facilities to prevent Dermatitis which experienced industrial physicians say is a common cause of absenteeism. They further agree that sanitary washing is a recognized preventive.

Long used by industry, Bradley Group Washfountains present the best in sanitary washing facilities. From 8 to 10 can wash simultaneously, each in his own clean running water—the self-flushing deep precast stone bowl preventing any collection of contaminating water. With adequate Bradley washing facilities, workers take less time to wash.

Each Bradley takes the place of 8 to 10 conventional "single-person" wash basins,—a Bradley requiring but three piping connections as against 24 to 30 for the wash basins. Critical metals are saved and installation simplified.

Reducing lost man-hours due to Dermatitis is the same as adding more men for War production . . . Protect your "behind-the-line" fighters—guard against lost man-hours for greater maintained production with Bradleys. Assistance in washroom layouts gladly given. Write for new Picture Book of Installations. . . . BRADLEY WASHFOUNTAIN CO., 2215 W. Michigan Street, Milwaukee, Wisconsin.

BRADLEY *washfountains*

AND MULTI-STALL SHOWERS

Right foreground shows two 5-in-one Bradley Showers.

Significant Labor Developments

(*Continued from page 109*)

istent wages were in excess of those paid in the area and by competitors elsewhere, even though the employees seeking the raise had not received the classic 15 percent increase since January, 1941. This would tend to equalize further the elasticity of the Little Steel formula, and to accentuate the principle that the basic consideration for WLB's granting increases is to remove inequalities. In this case the wages were 11 percent above those of employees competing in the same market. (Lever Bros. Company.)

* *Wage Increases Granted*

WLB granted retroactive wage increases of 7½c. an hour as a means of bringing the rates of the mills here involved up to the established rates in other mills in the cotton textile and in related textile industries that operate in the same labor market.

The compelling factor in these cases is the elimination of inequalities; hence the Board refused to consider the general subject of substandard wages or to become involved in the complexities of the long-standing North-South wage differential. (50 Textile Mills.)

WLB Compromises Claims for Increase

While WLB denied a general wage increase, it granted a series of increases to some employees in an effort to relieve them of inequalities: in one case (Parke, Davis & Company) by approving an arbitration award which granted substantial increases in wages, shift differentials, and vacation allowances, all of which had been offered by the employer in lieu of the blanket increases asked by the union; in another (Western Electric Company, Inc.) by ordering a series of increases where it found inequalities as a result of a slow-working wage progressive plan.

* *Increase Above 15 Percent Allowed*

In at least one case WLB allowed an increase though it is in excess of the Little Steel formula. The increase bringing the new rate above the 15 percent higher than the base (January 1, 1941) was justified on the ground that nearby plants on a special stabilization agreement were paying

THIS STARTER THAT SAYS:

"I'm 'on'
I'm 'off'
I'm 'tripped'"

Motor Watchman
Class 10-100
Size 1

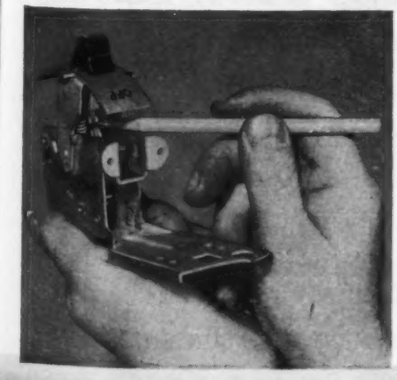
SAVES TIME
SAVES
MISTAKES!

WESTINGHOUSE "De-Ion" MOTOR WATCHMAN MANUAL STARTERS FOR A-C MOTORS UP TO 7½ HP

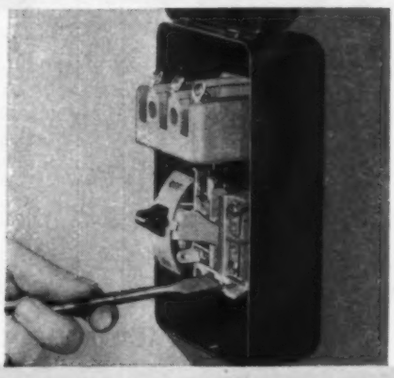
No question with the Motor Watchman, whether it is "ON" or "OFF," or whether an overload has caused it to trip and disconnect the motor. ALL THREE circuit conditions—"ON"—"OFF"—or "TRIPPED"—are clearly indicated by the handy toggle switch.

Toggle switch operation makes jogging motors for indexing easier, too. One hand does the job—quickly, accurately! "De-ion" Arc Quenchers prolong contact life—Bi-metal overload relay gives unvarying, factory-calibrated protection—straight-through wiring and keyhole mounting holes make installation easy. Order from your nearest Westinghouse Agent today. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. J-21183-A

QUICK-MAKE as well as quick-break action prevents "teasing" of contacts. Contacts cannot be held partially closed. Arcing is reduced—contact life lengthened.



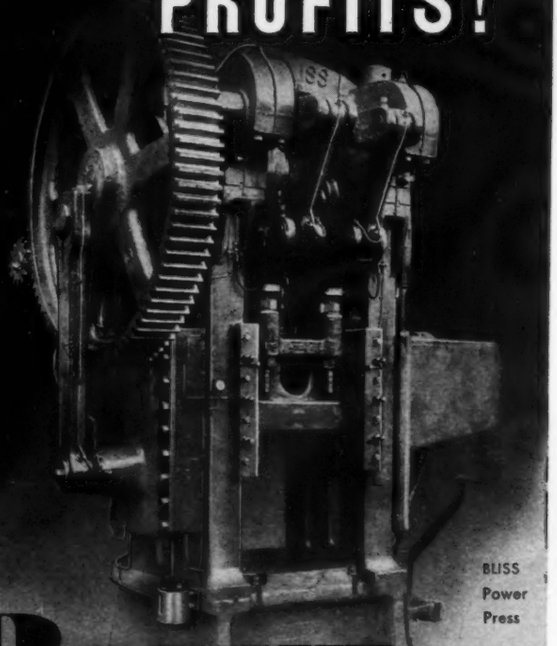
EASY TO INSTALL... terminals are out in the open, easy to get at. Through wiring, together with ample wiring space makes installation quick and simple.



Westinghouse

THOSE HIDDEN COSTS...NOW ARE PROFITS!

The correct oil film to each individual bearing... automatically



BLISS Power Press

BIJUR

AUTOMATICALLY Correct LUBRICATION

● Remember them? Oiling time lost from productive work . . . Lubricant wasted . . . Production delays . . . Increased depreciation.

● How those hidden costs gnawed at profits! Money that now is clear . . . simply by the convenient, economical use of BIJUR lubricated machines. Clean lubricant is pumped and fed automatically . . . to each bearing the correct oil film it individually requires. No lubrication troubles . . . even to think about!

BIJUR LUBRICATING CORPORATION LONG ISLAND CITY, NEW YORK

707

MEMO

CHECK THOSE NEW MACHINE SPECIFICATIONS. THE BEST MAKES HAVE AUTOMATIC LUBRICATION.

1558

higher wages. (Pacific Northwest Foundry Industry Employers.)

In a companion case the Board refused an increase which would gear the prevailing wage to the increased cost of living, again on the ground that such increase would bring the wage above those prevailing in the shipyard. (Washington Metal Trades.)

** Work Stoppage Denounced*

WLB will not tolerate work stoppages even though the employer was charged with having breached his contract, making the stoppage a lockout—no matter how justifiable the grievance. Said the Board: "The employee must rely upon his government to keep its pledge to him that impartial agencies and tribunals in which labor's representatives have a voice, along with industry, will continue to be available for the adjustment of grievances in accordance with their merits." (Detroit & Cleveland Navigation Company.)

** WLB Insists Upon Rigid Enforcement*

That WLB will not countenance the delays attendant upon litigation was made clear when the Board ordered obedience to a ruling of the NLRB. Such ruling will be considered valid until set aside. WLB declared "This is no time for dilatory tactics or to resort to legalistic strategies."

In another case (In re Lebanon Steel Corporation) WLB held that management has no inherent right to a review by the Supreme Court of an order of the NLRB requiring the company to bargain with a designated union.

** WLB Rejects Vacation Demand*

In further application of the principle of equalization, WLB prescribed maintenance-of-membership clause and check-off for the shipbuilding division of a steel company. At the same time it rejected the union's demand for a two-week vacation with pay instead of one week for employees with one or more years of service, on the ground that such a change in vacation policy in the shipbuilding division of the company from that prevailing in other divisions would not be in the best interests of stable operations; and, stability is what WLB seeks. (Bethlehem Steel Company Shipbuilding Division.)

Vacation Pay Not Part of Wages

NLB ruled that it does not regard vacation with pay a part of wages. As

WHERE *Power* LOAFS PRODUCTION LAGS

Throughout American Industry the New BullDog Vacu-Break Safety Switch is Helping to Keep Power on the Job . . . Speed Production—Reduce Maintenance Cost

The finest electrical distribution system in the world is no better than its switches. The right type of safety switches can keep power on the job every minute, free from current losses caused by lost motion in switch operation, by pitted or burned out contacts, by loose fitting contact devices.

The new BullDog Vacu-Break Safety Switch is that right type of switch, designed to meet today's emergency needs, to carry the loads of round-the-clock production schedules, to stand the wear and tear of *constant* operation and lack of adequate maintenance time.

Industry has been quick to see the advantages of the New Vacu-Break Switch—hundreds of the country's greatest war plants are specifying it as standard equipment, sure of its ability to "stand the gaff."

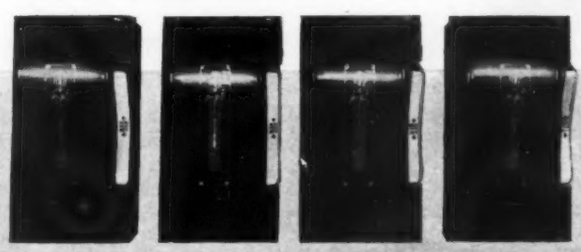
Cut-away view of new formed Bakelite arcing chamber shows how snugly the clamping pressure contacts fit therein.

PLUS FEATURES OF THE FRONT OPERATED VACU-BREAK SAFETY SWITCH

1. *"Clampmatic"* SWITCH CONTACTS: Provide in a very simple way, "Clamp type pressure" when switch contacts are closed, and at the same time, the switch operates more easily and quickly than switches having only ordinary pressure contacts.
2. QUICK ACTION MECHANISM: Assures positive "ON" and "OFF" operation. Provides front operation and enhances modern streamlined appearance.
3. FORMED BAKELITE "ARCING CHAMBERS": Confine arcs — prevent burning and pitting of contacts. Rugged current-carrying parts reduce maintenance and replacements.
4. SIMPLIFIED OPERATING MECHANISM: Greatly reduces parts necessary for smooth, positive and firm operation. No "lost motion" in operating mechanism.
5. WIRING ROOM—AMPLE yet COMPACT: The neat trim condition of switch interior is designed to provide maximum wiring space without sacrificing overall compactness.

Available in Master (Type A) and Standard (Type C) 30 Amp. to 200 Amp. inclusive

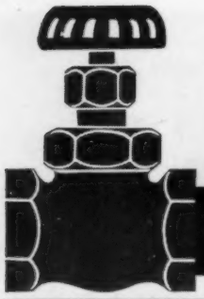
BUY WAR BONDS AND STAMPS



Rocker type handles positioned inside lines of cabinets enhance their fine streamlined appearance.

BULLDOG
ELECTRIC PRODUCTS CO.
DETROIT, MICHIGAN
BullDog Electric Products of Canada, Ltd., Toronto, Ontario
Field Engineering Offices in All Principal Cities

MANUFACTURERS ALSO OF SAFTOFUSE PANELBOARDS, CIRCUIT MASTER BREAKERS, SWITCHBOARDS, BUS DUCT SYSTEMS—FOR LIGHT AND POWER



A Time-Saving Valve FOR IMPORTANT PRODUCTION LINES

In these critical times when uninterrupted production is all-important, every minute saved in maintenance means more productive hours.

Lunkenheimer "N-M-D" (non-metallic disc) Valves cut maintenance time to the bone, because it's only a matter of minutes to renew a worn disc and keep the valve on the job.

Users of Lunkenheimer Valves are profiting from their wise policy of buying highest quality. They are getting continual tangible evidence of what really good valve performance means in dependable and low-cost service.

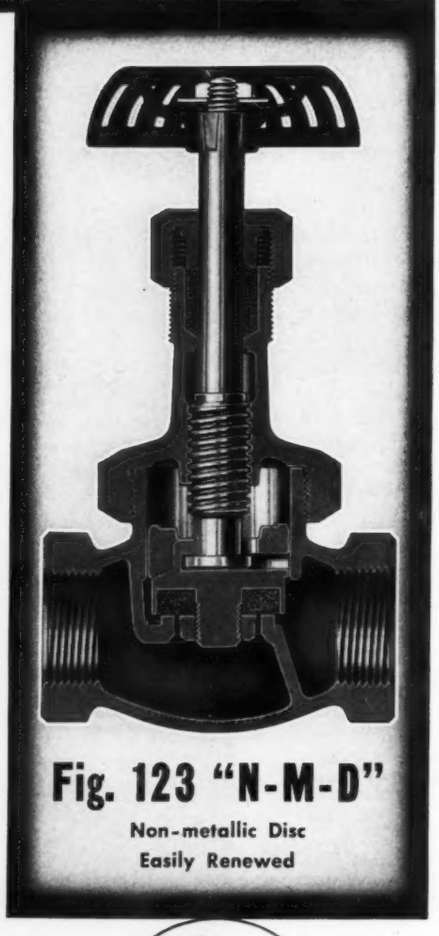
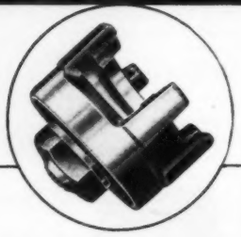


Fig. 123 "N-M-D"
Non-metallic Disc
Easily Renewed

Since virtually all materials used in the manufacture of valves are on the list of critical materials, valve users are urged to furnish the highest possible preference ratings and proper "end use" Allocation Classification Symbols on their orders. This will be of mutual helpfulness.



With a few spare disc holders complete with discs on hand, the time required for renewing can be cut to almost nothing.

ESTABLISHED 1862
THE LUNKENHEIMER CO.
"QUALITY"
CINCINNATI, OHIO, U. S. A.
NEW YORK CHICAGO
BOSTON PHILADELPHIA
EXPORT DEPT. 318-322 HUDSON ST., NEW YORK

LUNKENHEIMER VALVES

a general rule the Board agreed that vacation pay is clearly a part of a company's labor costs, and if the vacation is not taken—as in wartime it frequently will not be—the vacation pay certainly constitutes an addition to the employee's usual earnings. On the other hand, to hold this as a universal rule would often work manifest injustice, since it would logically result in lesser rate increases being given where vacation pay is granted than where it is denied; in fact, the employees would not be receiving vacations with pay. (Association of Team and Truck Drivers.)

NATIONAL LABOR RELATIONS BOARD

** Right of Management to State Case*

Greater freedom of action was allowed management when the National Labor Relations Board sanctioned direct appeals to strikers to return to work in a case in which the strike was not caused by unfair labor practices. Furthermore, ruled the Board, the employer may publicize his views on the merits of the strike and he may show that it was unjustified or interferes with war operations, where he was already dealing with an inside union that represented a majority of his employees. (Norwood Sash & Door Manufacturing Company.)

** Court Will Not Compel Closed Shop*

Judicial opposition to the union shop was reflected by a California court's refusal to compel an employer to discharge an employee who declined to apply for membership in the union.

The court reasoned that by the terms of the contract, the employer agreed that new employees should make application for membership. No provision, however, required the discharge of those who did not make such application.

Courts will not make contracts for parties, nor insert terms that should have been expressly provided. (Turner vs. Capital Envelope Company.)

Strike and Demonstration Distinguished

The Board called attention to a highly practical distinction when it differentiated between a strike and a demonstration. Where a strike is called, management will not be charged with discrimination until the employees had been refused re-employment after having made unconditional application.

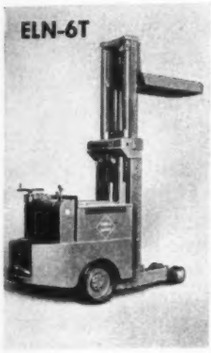
If labor's activity is a mere dem-

Modern ELWELL-PARKER Trucks and Cranes

AVAILABLE IN STANDARD TYPES AND SIZES

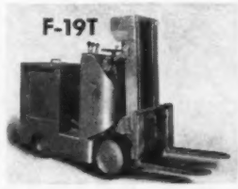
LIFT TRUCKS

Type	Capacity	Overall Length	Overall Width	Platform Size Length	Platform Size Width	Height at Low Position	Lifts	Turns Intersecting Aisles	Approximate Weight with Power Unit
EQ-4	4,000 lbs.	87¼″	31¼″	41″	18½″	7″	3¼″	50″	2,900 lbs.
EP-4	4,000 lbs.	112½″	38″	54″	26½″	10½″	6″	64″	4,100 lbs.
EP-6	6,000 lbs.	119½″	42¾″	54″	26½″	10¾″	5¾″	69″	4,900 lbs.
GEP-6 (Gas)	6,000 lbs.	125⅞″	42″	54″	26½″	10¾″	5¾″	72″	4,050 lbs.
EP-10	10,000 lbs.	129″	42¾″	60″	26½″	11″	5¾″	71″	5,500 lbs.



TIERING TRUCKS

Type	Capacity	Overall Length	Overall Width	Platform Size Length	Platform Size Width	Height at Low Position	Height Overall	Lift	Turns Intersecting Aisles	Approximate Weight with Power Unit
ELN-6T	6,000 lbs.	129⁷⁄₁₆″	42¾″	54″	27″	11⅛″	83″	113″	70½″	7,000 lbs.
ELN-6	6,000 lbs.	126″	42¾″	54″	27″	11⅛″	83″	62″	69″	6,300 lbs.
ELN-10	10,000 lbs.	137½″	43″	60″	27″	11″	95″	69½″	76″	7,500 lbs.



FORK TRUCKS

Type	Capacity Up to	Long Load	Overall Length 36″ Forks	Overall Width 36″ Forks	Telescoping Truck Lifts Up to	Height, Uprights Collapsed	Turns Intersecting Aisles	Approximate Weight with Power Unit
F-19T	6,000 lbs.	60″	123″	46″	117″	83″	76″	12,200 lbs.
F-25T	10,000 lbs.	48″	141″	51½″	100″	83″	86″	15,500 lbs.
F-23T	5,000 lbs.	42″	118¾″	41″	117″	83″	70″	9,300 lbs.

CRANES

Type	Capacity Lbs. @	Overall Length	Overall Width	Boom	Slews	Platform Size Length	Platform Size Width	Platform Size Height	Turns Intersecting Aisles	Approximate Weight with Power Unit
C-4	3,000 lbs. 7′	107¾″	50″	12′-19′	292°	15″	41″	17¼″	69″	10,800 lbs.
CX-4	6,000 lbs. 7′	134¾″	63″	12′-19′	204°	40⅜″	63″	16⅜″	94″	13,400 lbs.
CZ	10,000 lbs. 5½′	132⅜″	64½″	12′-19′	296°	28¾″	50″	25¼″	88″	18,000 lbs.
EP-6C	2,000 lbs. 3½′	129⅜″	42¾″	5′-8′	180°	26½″	54″	10¾″	70″	7,000 lbs.

(Boom mounted on EP-6 Lift Truck)

Elwell-Parker concentrates on these basic types, to give you deliveries of Trucks and Cranes that will meet your scheduled requirements, saving or multiplying manpower to handle your War Loads. Ask Elwell-Parker Engineers to survey your Plant.

The Elwell-Parker Electric Company, 4323 St. Clair Ave., Cleveland, Ohio.

ELWELL-PARKER Power Industrial TRUCKS

ESTABLISHED 1893 • BUILDING POWER INDUSTRIAL TRUCKS SINCE 1906

FIBBER McGEE: "Our sponsor's mighty busy makin' wax-fortified paints."

MOLLY: "An' mighty good paints they are, McGee."

JOHNSON'S

Wax-Fortified

MACHINE ENAMEL

Made by the makers of Johnson's Wax

Tough, resists dirt and marring, requires minimum maintenance

Here's one enamel that WILL stand up against wear and tear, machine and cutting oils, strong cleaning agents. In addition, Johnson's Machine Enamel (because it is impregnated with genuine wax) is grease-and-dirt resistant. It repels water. It's easy to wipe clean. It cuts maintenance costs and time.

Today all machines and equipment *must* be conserved, must last longer. Johnson's Wax-Fortified Machine Enamel is specially made to help "conserve what we have." Available in White, Light Gray 7-B, and Dark Gray. Application may be by brush or by spray methods. Write for helpful catalog, the "Why and What" of Wax-Fortified Paints.

S. C. JOHNSON & SON, INC.
INDUSTRIAL MAINTENANCE DIVISION
Dept. FM-102, Racine, Wisconsin

Get in the Scrap-with your Scrap!

onstration, any refusal to re-employ which is based on the concerted activity would expose the employer to a charge of violating the Wagner Act. (Johnson Steel & Wire Company.)

** State Labor Board Alters Contract*

A Pennsylvania court ruled that its State Labor Relations Board has the authority to sever a craft unit from an individual unit even though this severance was decreed after the renewal of a contract made with a union representing the employees in the industrial unit.

The fact that the Federal Constitution prohibits impairment of the obligation of contract did not deter the Board since the parties to the renewal contract were aware when the contract was re-negotiated that the question of the unit was under consideration of the Board and that it had the statutory authority to fix the unit. (Grand Bldg., Inc.)

** Labor and Non-Labor Conspiracy Illegal*

Federal District Court held a union would be violating the anti-trust laws if it agreed with a film distributor that the latter refuse to supply exhibitors unless they employed members of the union as projectionists. This method of eliminating competition by a conspiracy between labor and non-labor groups, held the court, violates the Sherman Act. Since there is no labor dispute here involved the union will be enjoined from exerting its economic pressure on the distributors. (Loews, Inc. vs. Basson.)

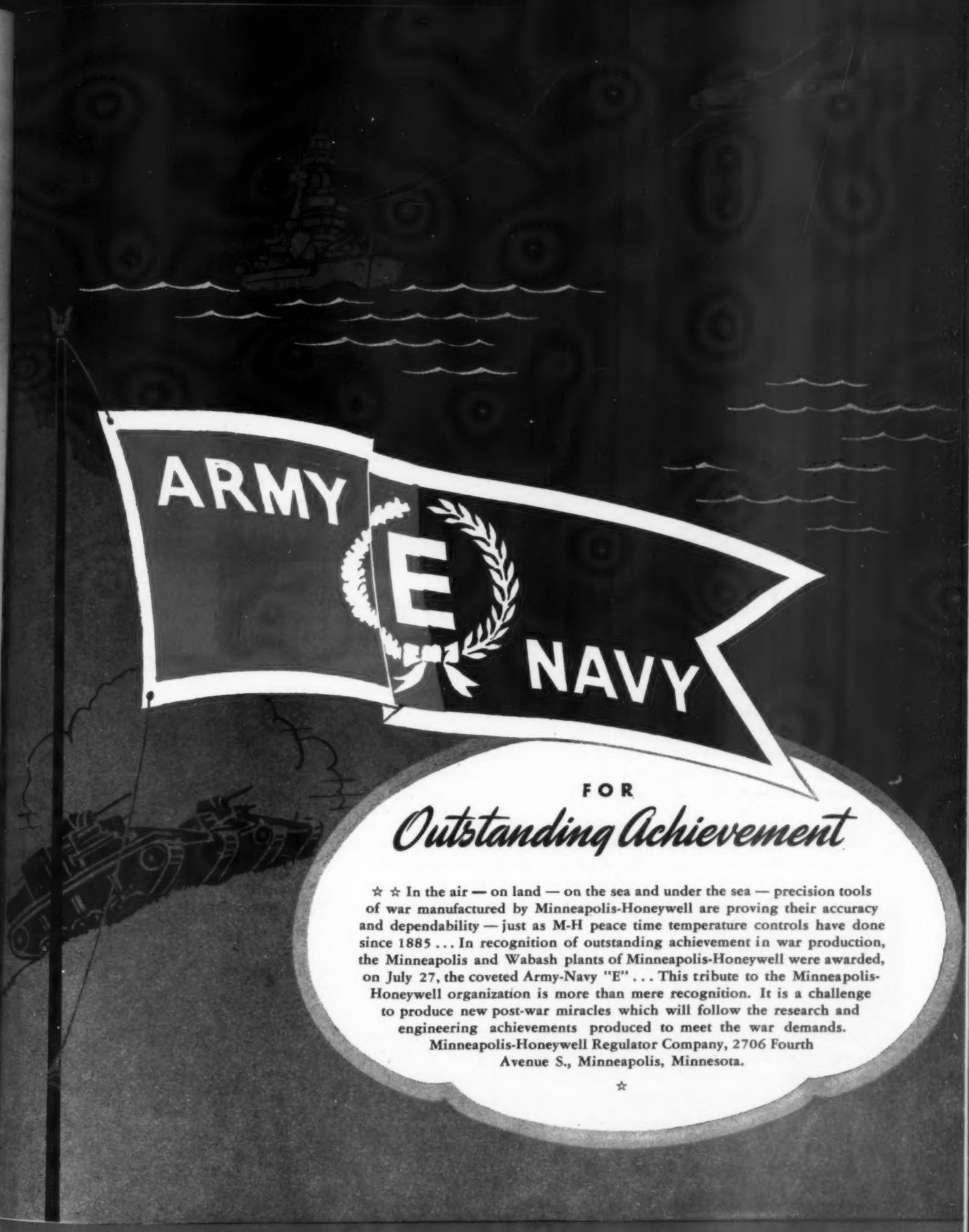
** Board Refuses to Review Election*

NLRB refused to review an election which, it was charged, was won by an unfair appeal. In all the seven years of the Board's existence it has set aside many results because of interference by employers—only twice has it disallowed an election because of improper activities of unions. (Curtiss Wright Corporation.)

Conduct Held Not Illegal

Held not discriminatory conduct—the transfer of an employee who was active in union promotion to a job on which he could not proselytize as abundantly. Even the union agreed that his zeal was retarding his production. (Helena Rubinstein Inc.)

Held not an interference with employee rights—the refusal of an employer to handle grievances of its employees with an outside union and his appeal to strikers and the public telling his version of the controversy.



FOR

Outstanding Achievement

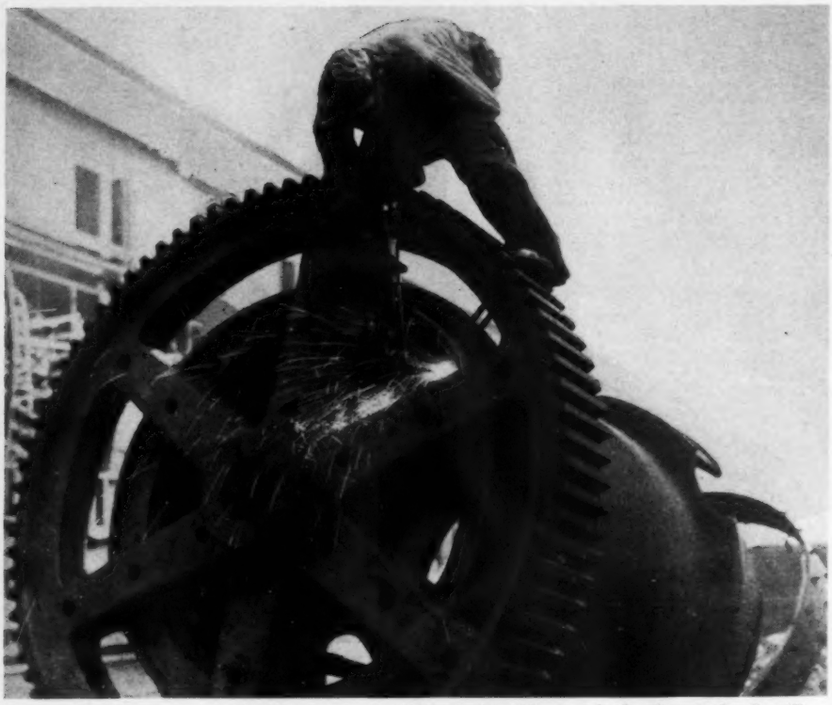
☆ ☆ In the air — on land — on the sea and under the sea — precision tools of war manufactured by Minneapolis-Honeywell are proving their accuracy and dependability — just as M-H peace time temperature controls have done since 1885 . . . In recognition of outstanding achievement in war production, the Minneapolis and Wabash plants of Minneapolis-Honeywell were awarded, on July 27, the coveted Army-Navy "E" . . . This tribute to the Minneapolis-Honeywell organization is more than mere recognition. It is a challenge to produce new post-war miracles which will follow the research and engineering achievements produced to meet the war demands.

Minneapolis-Honeywell Regulator Company, 2706 Fourth Avenue S., Minneapolis, Minnesota.

☆

MINNEAPOLIS-HONEYWELL

Regulator Company



"Gertie" was cut up and fed to the Inland furnaces the day she arrived at the mills.

"Old Gertie" Goes to War

Inland Mine Hoist Makes Scrap for Hungry Furnaces

To help meet the critical need for scrap, an auxiliary mine hoist once affectionately known as "Gertie," was taken out of retirement at one of the Inland ore mines and shipped to the company's mills at Indiana Harbor. The need for scrap is so urgent that "Gertie" was cut up and fed to the hungry Inland furnaces the day she arrived at the mill. She was rolled into steel plates and soon will be a part of a Liberty ship carrying vital war supplies to the fighting fronts.

"Gertie" is typical of many pieces of equipment in factories, mines, etc. throughout the country. Replaced by a modern electric hoist several years ago, this old mine hoist was stored because it "might come in handy some day." Holding old machinery, stacks, tanks, tools, jigs, dies, even partly finished parts, for possible future use is a commendable practice in ordinary times. But this is war—*total war*—and everything made of steel, that is not being used to produce for war, ought to be scrapped and started on its way to the steel mills at once.

Many steel mill furnaces are down, while millions of tons of needed scrap remain unreclaimed. The scrap situation is critical now and it will become more critical as winter approaches, unless management of American industry gives authority to scrap old equipment and materials.

If you can't use it *now*—scrap it.

SHEET · STRIP · TIN PLATE · BARS · PLATES · FLOOR PLATE · STRUCTURALS
PILING · RAILS · TRACK ACCESSORIES · REINFORCING BARS

Dedicated to Victory

INLAND STEEL CO.

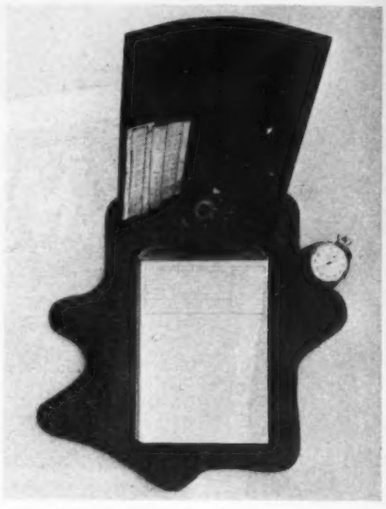
38 S. Dearborn Street, Chicago · Sales Offices: Milwaukee, Detroit, St. Paul, St. Louis, Kansas City

Management Shorts

(*Continued from page 112*)

but when we fastened the heavy, leather shield to the board it was too tiring to the arm for prolonged use. Constant folding of the leather holders of the light leather shields weakened them.

We then decided to try a light metal lens holder which could be attached



to the top of the time study board. After some experimentation, we adopted the shield shown in the photograph as standard in our plants. It is now possible to get right up to the arc without fear of burned eyes or arc burn. The time study man can then watch the molten metal or his watch and pad at will. He is freed of the weight of heavy goggles or shields although light safety goggles are generally worn as protection from nearby arcs.

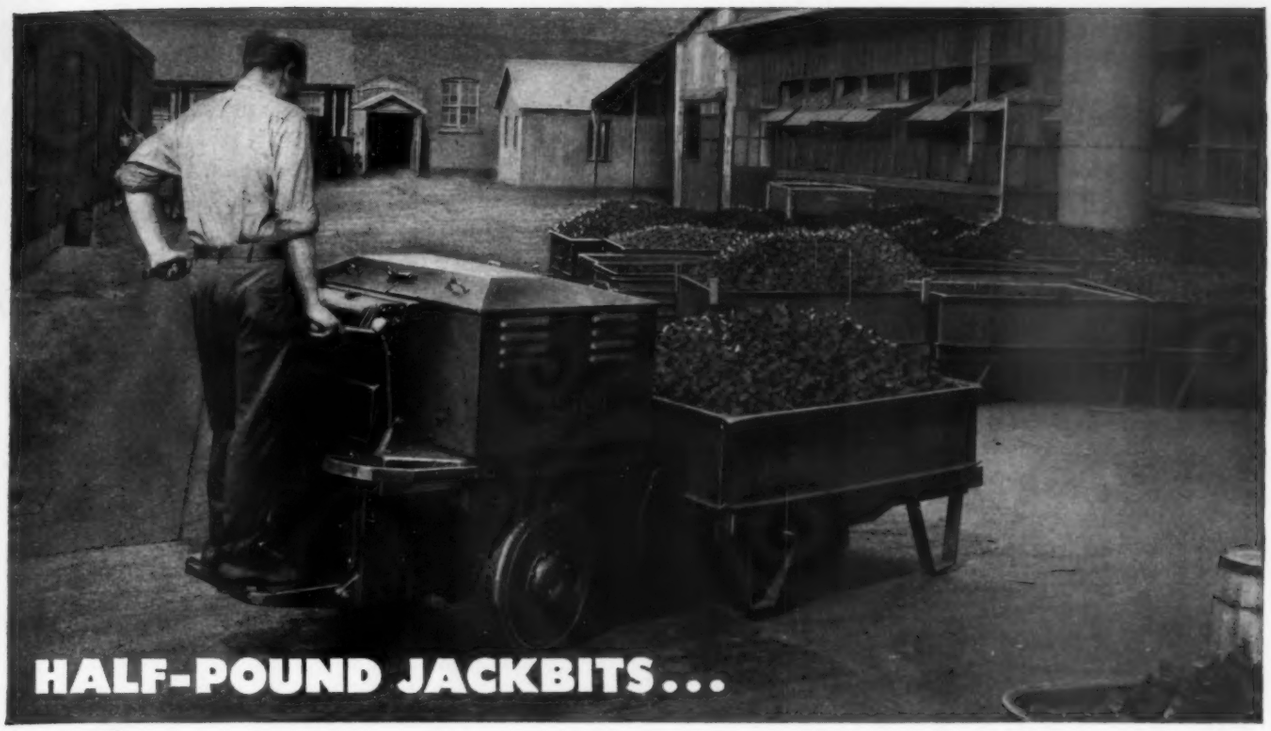
•

Midget Crane Solves Handling Problem

EDWIN H. SCHAEFFER, Industrial Engineer, J. E. Ogden Co., Bayonne, N. J.

For stacking and setting up tote pans of material weighing about 250 pounds, we needed a rapidly operating lifting unit which could travel over an area of about 50 feet radius and which could be easily maneuvered in narrow 30-in. spaces between work tables. To handle this "in-between" weight—too heavy for a man to lift and too light for most conventional handling equipment—a portable midget crane was designed and built.

A 500-lb. electric hoist, a 50-ft. cable reel with automatic take-up, and 4 swivel casters were purchased. From the scrap heap, a piece of 2-in. pipe and a few lengths of steel angle were salvaged. With



HALF-POUND JACKBITS...

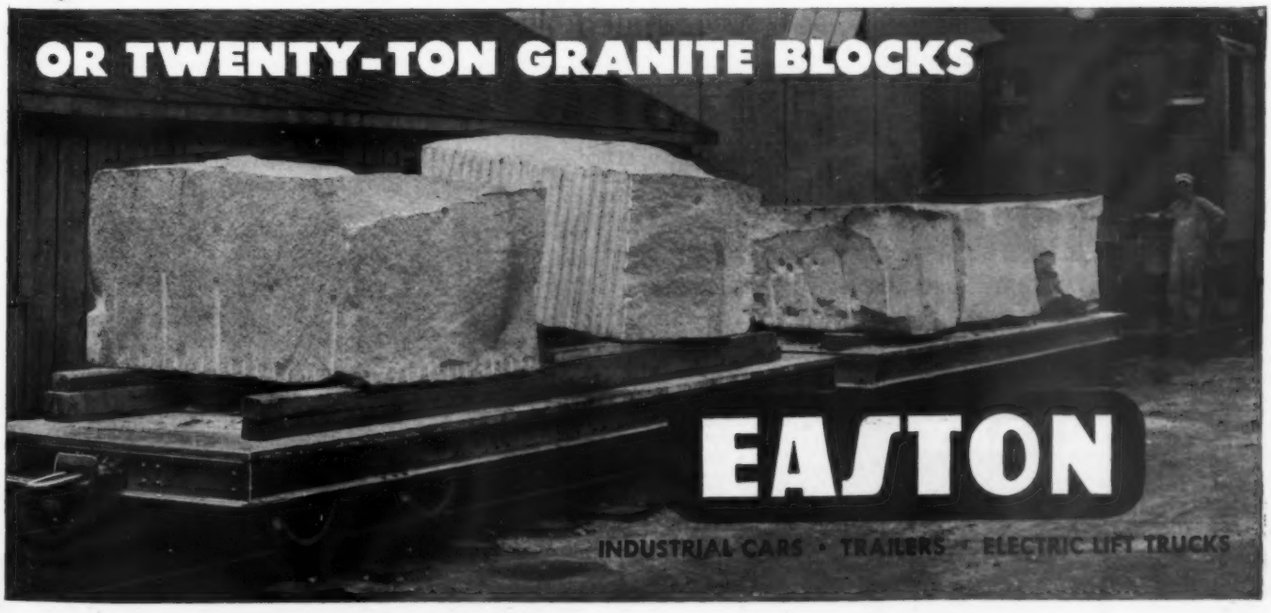
A LARGE MANUFACTURER of machinery put these two widely different material handling problems up to Easton Engineers. Photographed above are skids filled with jackbits. Below are blocks of Barre granite which are used in testing rock drilling machinery at the same plant.

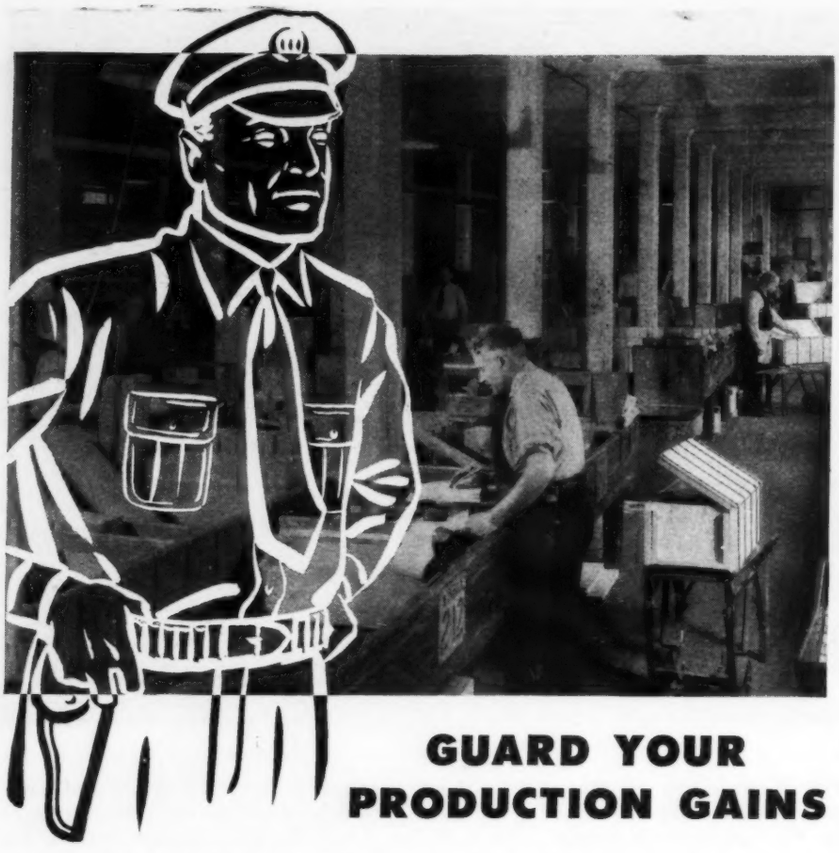
Standard Easton LL-4 low-lift electric trucks were installed for efficient intraplant handling of the two-ton skids of jackbits. Two forty-ton double-truck platform cars of standard railroad gauge were built by Easton to move the granite from railroad siding to testing ground.

In addition to the cars and the electric truck illustrated Easton Engineers have designed and built, for the same company, core oven cars for use in the large foundry, twenty-ton steel platform cars for transferring heavy foundry molds, tier-lift electric trucks for handling castings from truck delivery to machine shop, all steel platform trailers for intrashop handling of cumbersome welded structural forms, and various other standard and special industrial cars and trailers for handling light and heavy loads.

Similar experience in providing the right equipment for efficient handling of various loads and materials at many other factories, warehouses, mines and quarries has established Easton as a headquarters for the engineering and manufacture of all types of industrial cars, trailers, and electric lift trucks. For assistance with your problem of moving materials write to Easton Car & Construction Company, Easton, Pa.

A1000





GUARD YOUR PRODUCTION GAINS

● Keep the benefits of greater output effective . . . by making sure that your war shipments are shipped the fastest, safest and easiest way. Engineered Shipping Containers are helping hundreds of war products manufacturers eliminate delay in their shipping rooms—and to speed vital shipments to the armed forces or to war products assembly lines.

General Shipping Containers are facilitating the shipment of all types of war products on land and sea. Engineered to meet shipping requirements, General Containers assure important savings in vital man hours, conserve space in ships, trucks, trains and on shipping room floors.

Skilled General Box technicians co-operate with manufacturers often before production is started, to determine the box, crate or special container best suited for each requirement.

Your products also can have the benefit of General Box research. You can be sure of adequate protection and faster, safer handling and shipping. A new, illustrated booklet shows how products, similar to yours, are shipped in General boxes, crates, or specially designed containers. Send for it—there is no obligation.

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☐ Send a free copy of the booklet, illustrating engineered Shipping Containers.
☐ Have a General Box engineer call.

Name .....
Address .....
City ..... *State* .....

a little bending, cutting, and welding, and the addition of an imitation bicycle handle bar for steering, the crane was built. A cable reel was mounted centrally on the ceiling and connected to a power

supply. By connecting the feed cable to the electric hoist hooked on the boom of the crane, free movement is possible over an area limited only by the cable length. An automatic take-up eliminates dragging or dangling wires.

With this crane less effort is required to perform a given amount of work, there is no strain on those handling the material, and a greater volume can be moved satisfactorily at lower cost.

●

Cash Awards Promote Foreman Efficiency

SOURCE—American Car & Foundry Company, New York

A plan for rewarding foremen in accordance with their performance over a given period has recently been put into practice in one of our shell making plants. The purpose of the plan is to improve quality of foremanship by means of meetings, discussions, and instruction; and further by establishment of a cash incentive to promote alertness to duties and responsibilities.

A chief consideration is the relation of the foreman to the performance of the men. Results are computed by means of percentages to secure a mathematical rating. This rating is based on:

1. Total number of hours against a par.

2. Attendance of the foreman and of his men.

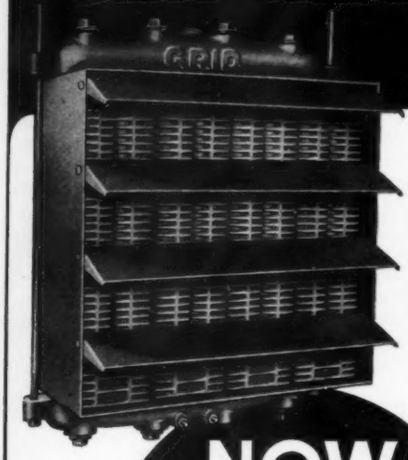
3. Punctuality of the foreman as recorded by the time clock.

4. Scrap or spoiled material due to poor workmanship based upon the production of the department.

5. Defective machining or workmanship based upon the production of the department.

6. Cost of cutting tools.

IT'S STILL A *different* UNIT HEATER



High test cast iron takes the place of aluminum for the heating sections, to cooperate with the war effort in using substitute materials — but it's still the ultimate in unit heater quality.

NOW made with CAST IRON Heating Sections

A special design for performance. Patent applied for.

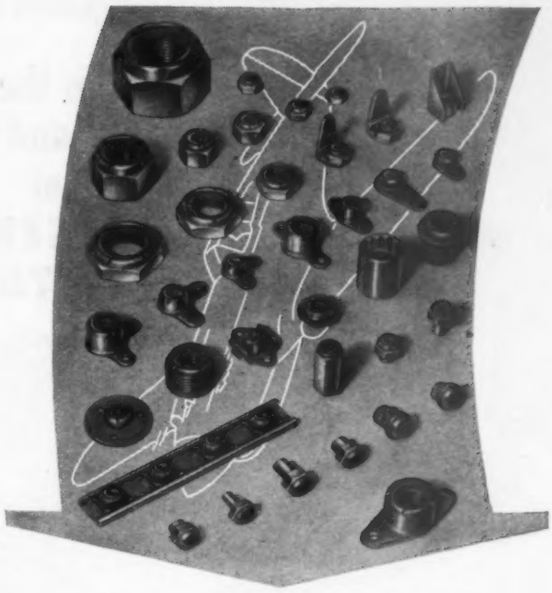
THE new Grid is engineered along the same lines as the standard Grid Unit that had aluminum heating sections.

No corrosion—no leaks or breakdowns . . . In this new Grid Unit there is only one type metal in contact with steam or hot water. There is nothing to cause electrolysis that produces corrosion. Engineered and constructed to withstand up to 250 lb. steam pressure.

The new Grid Unit Heaters will give you years and years of dependable service, the same as the aluminum heating sections Grid Units—and many of these units now 14 years old are operating as efficiently as the first year. Ask for catalog, engineering data and capacity tables now.

D. J. MURRAY MFG. CO.
WAUSAU, WISCONSIN
Offices in all Principal Cities

GRID UNIT HEATER



PROVED ON AIRCRAFT

. . . and now used in every industry

1927 saw the first application of Elastic Stop Nuts on airplanes. When it was proved that these self-locking fastenings hold tight under any combination of vibration, shock, stress, and weather exposure, they were adopted for vital connections on all American military and transport aircraft.

Meanwhile other industries, profiting by such a convincing demonstration in the air, solved many of their most troublesome fastening difficulties with the same reliable nuts.

Today there are more Elastic Stop Nuts on America's airplanes, tanks, guns, Naval vessels, and production equipment, than all other lock nuts combined.

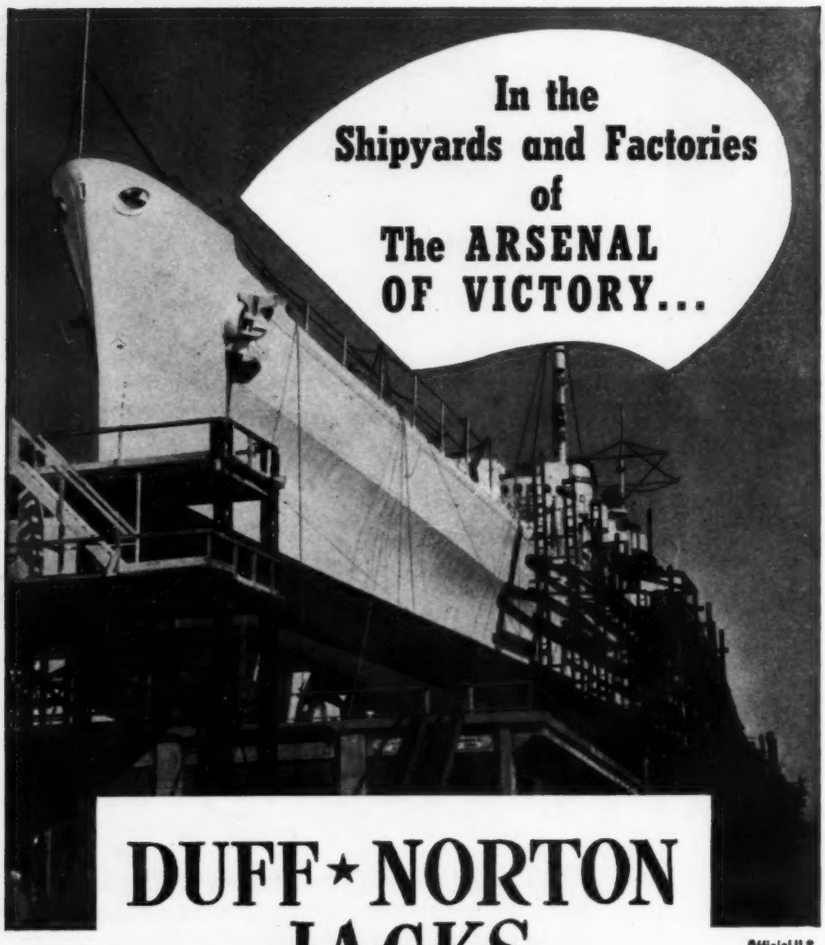
ELASTIC STOP NUTS may be the solution to *your* fastening problems. Sample nuts, for laboratory or field testing, will be furnished without cost or obligation.

» Write for interesting folder explaining the Elastic Stop self-locking principle.

. . . And see the Elastic Stop Nut Exhibit at the National Metal Exposition.

ELASTIC STOP NUT CORPORATION
2336 VAUXHALL ROAD • UNION, NEW JERSEY

WITH THE RED LOCKING COLLAR . . . SYMBOL OF SECURITY



DUFF★NORTON JACKS

Official U.S. Navy Photo

serve faithfully and well!

Ball Bearing Screw Jacks for Extra Heavy Duty.

● Wherever you find men at work—helping produce the ships, guns, tanks and tools that will win the war—you find Duff-Norton Jacks providing "mechanical muscles" to speed the fight for victory.

No matter how tough the job—no matter how gruelling the service, Duff-Norton Jacks are doing faithfully and well every kind of lifting, lowering, pushing, pulling.

Low Height Journal Jacks.

Hundreds of types and sizes of these husky Jacks stand ready to help you meet production schedules. Every Duff-Norton Jack will give you safe, dependable, efficient service.

Send for Catalog

Catalog 201 will provide you with 64 pages of valuable Jack data—complete specifications on the entire Duff-Norton line. Write for your copy today!

Bell Bottom Jack Screws.

"The House that Jacks Built"

THE DUFF-NORTON MANUFACTURING CO.
PITTSBURGH, PENNSYLVANIA

Canadian Plant:
COATICOOK, QUEBEC

Representatives in Principal Cities

7. Cost of operating supplies used in comparison with an established limit.

8. Cost of indirect labor in comparison with an established limit.

9. Percentage of day work in the department.

10. Number of machines down in the department and number of machine hours lost.

11. Safety record of the department.

In addition to the above, the foremen are judged and marked for certain intangible qualities such as their conduct, energy and personality, their knowledge of the job, their judgment and common sense, cooperation, leadership, initiative, the cleanliness of the department, their labor relations—how they get along with their men.

Among the tangible results of the plan is the awakening of the men to their responsibilities. It has opened their eyes to undesirable conditions existing in their department and has resulted in a saving of a considerable amount of money to the company. Also, it has fostered a good feeling among the foremen who look forward to the award which is made at a buffet supper.

•

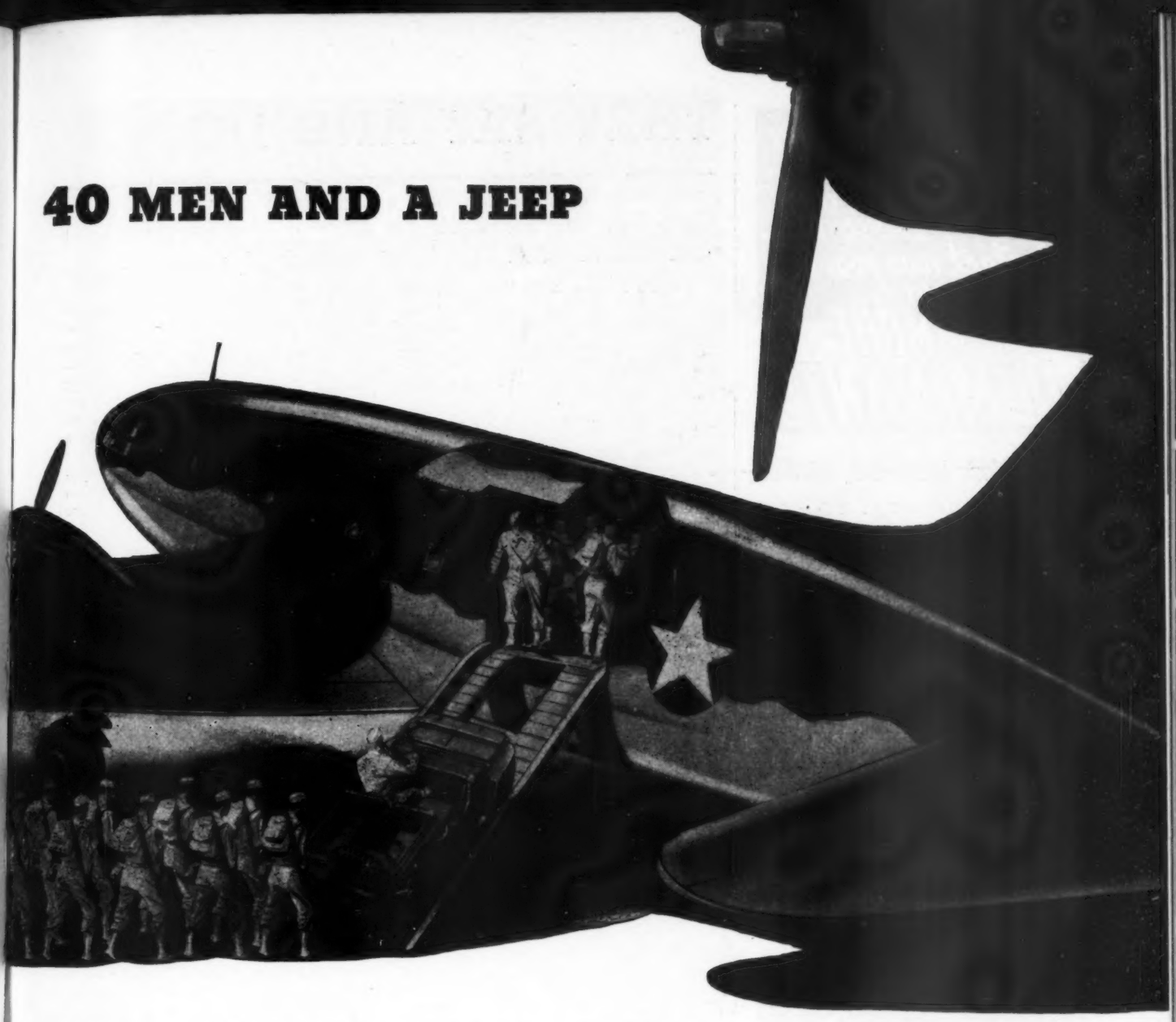
Welding Plays a Part in Handling Material

SOURCE—Harnischfeger Corporation, Milwaukee

In a plant cutting light sheet metal into 16-in. squares, the squares were taken from the shearing machines and stacked six piles to a platform. Whenever the

platform was bumped or moved, the sheets slid to the floor and delayed machine operators and movers until they were restacked. An operator drew a simple sketch of a cradle to hold the squares in stacked position and turned it over to the welding department. Several cradles consisting of a bent plate, four angle-iron posts, and a center partition with a lifting eye were made and put into use. As a result, flow of material from the shears increased over 18 percent.

40 MEN AND A JEEP



"GETTING there fustest with the mostest men" is still rule one for winning a battle. Today's wars depend upon the speed with which troops and their fighting equipment can be moved to the place where they are needed.

Rolling off production lines in America's great aircraft factories are huge freighters of the airways—planes as big as a boxcar that can span a continent between daylight and dark.

These leviathans of the air owe their tremendous carrying capacity as well as the speed with which they fly to the giant engines that power them.

To transmit the power of thousands of horses to whirling propeller blades, the gears in these engines must of necessity be held to such close tolerances that engineers have long considered them a laboratory product.

But laboratory methods of production could not be expected to furnish enough gears for the thousands upon thousands of fighting planes, bombers, and transports that are required to win a war.

The solution came in the production of gears of laboratory precision by mass methods, and today in the precision gear plant of Foote Bros., modern industrial might is helping solve the problem of more horsepower for engines—produced in ever-increasing quantities to meet war's insistent demands.

These new techniques—these new skills translated into post-war production mean that peacetime speed reducers and peacetime gears will assure better machines—quieter machines—that promise greater savings to American manufacturers.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5301 S. Western Boulevard • Chicago, Illinois

FOOTE BROS.

SPEED REDUCERS * GEARS * SPECIAL ASSEMBLIES

Comply WITH BLACKOUT REGULATIONS...
Safeguard YOUR EMPLOYEES...
Protect YOUR PROPERTY WITH...
KENMORE LUMINANTS

... SIGNS, INDICATORS, MARKERS

KENMORE LUMINANTS . . . signs, indicators, and markers that softly glow in the darkness after exposed to light . . . meet today's blackout conditions, as well as fill the normal functions of directional signs, day and night. They are now in use in many large industrial plants and buildings.

KENMORE LUMINANTS transfers (decalcomania) can be applied permanently to almost any surface. They can be also furnished with gummed backing (at a lower figure).

KENMORE LUMINANTS are long-lived—Laboratory test proves that these signs glow for 24 hours and last for many years . . . they are waterproof and can be readily cleaned.

Fill in the attached coupon and mail at once

KENMORE LUMINANTS CO.
450 OLD ARCADE CLEVELAND, OHIO

Above Signs Are Made With Red Background

KENMORE LUMINANTS CO.
450 Old Arcade, Cleveland, Ohio

Gentlemen:
Please send me sample and quotations on KENMORE LUMINANTS signs, markers and indicators.

Our special requirements are: .....

Company .....

Address .....

City..... State.....

Att. To: .....

THEY SAY AND DO

Ordnance Urges Redesign and Conservation

The old tradition of "stiff-necked Army insistence on rigid specifications" has been dealt another blow by Maj. Gen. Lavin H. Campbell, Chief of Ordnance, who has addressed a strong appeal to war contractors to save materials through redesign and substitution.

One hundred thousand copies of a booklet entitled "Tremendous Trifles" have been distributed to manufacturers, engineers, and Army men by General Campbell to launch his new "Tremendous Trifles" campaign. The booklet cites 14 examples, out of hundreds available, of ways in which critical material, critical machine time, and critical manpower have been saved by ingenuity in the redesign of ordnance items.

"There is no advantage in three times the steel production, for instance, if the Axis makes theirs go three times as far," the booklet points out. "Thousands of ordnance items that we are now making from critical materials and critical machines must be made from less critical materials by mass production methods, and less critical machines. Here are a few examples of savings:

"Single suspension lug. Designing this lug in pressed steel and mass producing it on otherwise idle printing presses made available thousands of bombs that were waiting for forged lugs. On one lot of 100,000 . . . 17,000 pounds of steel and 8000 machine-tool hours were saved.

"Booster Adapter. A 3.85-lb. steel bar and 0.23 machine hours were required to produce a 1.81-lb. adapter. On 1,500,000 adapters pressed from steel the saving will be enough for 3060 1-ton bombs and 210,000 machine tool hours, and 25 screw machines were released in two ordnance districts alone. Only 3500 pounds of copper were used in hydrogen copper brazing."

Manufacturers are helping the Ordnance Department to bring industry's attention to the drive. A copy of the booklet was forwarded to editors from the Mullins Manufacturing Corporation, Salem, Ohio.

•

New Group to Study Suggestion Systems

A new and concerted industrial attempt to get at the bottom of the suggestion system problem has begun in Chicago.

The National Association of Suggestions Systems has been founded to probe the causes of past failures and to ascertain the principles of success in the operation of suggestion systems so that "by stimulating millions of employees throughout the United States to produce suggestions, we will be going a long way toward winning the war."

Through the years, very few suggestion systems have been consistently effective, it was pointed out at the organization meeting. Bylaws were adopted, stating that the purpose of the new association is "to improve employer-employee relations, stimulate constructive thinking on the part of both, and, in general, enhance a sympathetic understanding of mutual problems toward making this a better working world to live in."

E. S. Taylor, director of the Employees' Suggestion System of the Pullman Company, was elected president of the Association. F. A. Denz, United Airlines, was named secretary, and H. T. Marmaduke, Illinois Central Railroad, treasurer. H. W. Feinwerth, Swift & Company, F. R. Evers, Public Service Company of Northern Illinois, and H. F. Foley, Peoples Gas, Light & Coke Company, were elected directors.

All companies having or planning an employees' suggestion system are eligible for membership, Taylor announced.

•

U. S. Training Film Service Expands

Industry will get the benefit of a $1,000,000 training film appropriation, the first money Congress has ever earmarked exclusively for the production of motion pictures, when the U. S. Office of Education of the Federal Security Agency expands its already extensive program for the production of "Textbooks in Celluloid."

With 48 films already completed, the production of 140 new ones will be made possible by the additional appropriation. Distribution of the original 48 releases, which have already reached a total of 8,000,000 feet of 16-mm. film, has greatly exceeded all the original expectations.

Castle Films, Inc., of New York, is the distributing agency handling the films for the Federal Security Agency.

Basic industrial operations, including machine shop practice, blueprint reading, precision measurement, and the essential principles in the use of many types of machines, were featured in the initial 48 films.

Topics for the forthcoming program are now being selected. A substantial number will deal with shipyard operations (with which many of the existing films also deal) and airplane manufacturing. Dr. John W. Studebaker, U. S. Commissioner of Education, pointed out the urgent need for the new series of films, many of which will be especially adapted to the training of women without previous industrial experience. It is estimated that more than

No Place for Camouflage...

A production line is no place for camouflage, but it could be that dull, dingy walls, ceilings and work surfaces are unintentionally camouflaging your employes' precision work.

Lowe Brothers Industrial Maintenance Finishes will multiply the productivity of your man power by reducing excess rejects, spoilage and wastage.

Without interruption of work Lowe Brothers can show you how to increase the light reflection value of your ceilings, walls and work surfaces to improve worker morale, reduce fatigue, and step up the production of better work for Victory.

Why not let Lowe Brothers advise you on an efficient, practical program of multiplying your man power by the proper application of interior paint—or conserving your physical property with exterior paint?

INDUSTRIAL SALES
THE LOWE BROTHERS CO.
DAYTON, OHIO.

Lowe Brothers

WARTIME MAINTENANCE PAINTS
AND WAR PRODUCT FINISHES

IN ACCORDANCE WITH U. S. GOVERNMENT SPECIFICATIONS

Amazing!

how WALLUSTRE hides

MAINTENANCE, with a minimum of interruption to operating schedules, is of utmost importance today. That's why the Devoe Laboratories developed Extra-Hiding High Gloss WALLUSTRE, the modern paint that **does the job in just one coat.**

Another reason why maintenance engineers specify WALLUSTRE for all interior wall surfaces is that its lasting whiteness insures proper reflection and diffusion of every bit of light available.

Eight outstanding advantages make WALLUSTRE the maintenance paint for you to specify for your plant:

1. One-coat hides black.
2. Amazing initial whiteness.
3. Stays white longer.
4. Modern synthetic vehicle.
5. Tough — long lasting.
6. Brushes smoothly — easy to apply.
7. Ideal for spray application.
8. Economical — high spreading rate.

If conditions in your plant indicate a paint with high resistance to moisture, fungi or fumes, your Devoe Maintenance Representative can help you select the specialized type you need.

Write today for pamphlet **WL-17** describing the complete Devoe Wallustre Maintenance Paint Line.

By improving sight with paint you help the National Safety Council's drive to reduce accidents and you build better morale among the workers in your own establishment.

DEVOE & RAYNOLDS CO., INC.

The 188th year of the oldest paint-maker in America

FIRST AVENUE AT 44th STREET, NEW YORK, N. Y.

5,000,000 women will be required in America's war industries and shipyards during the coming year.

This testimony in favor of the use of visual education in the training of beginners is given by John M. Amiss, Industrial Education Director of the Chrysler plant in Detroit.

"Recently, as an experiment, one of our instructors called in 10 new apprentices who did not know how to read a micrometer. He merely showed the micrometer film twice to the group without any explanation or discussion whatever. He then brought in some micrometers and test blocks and had the group use the micrometers. Only one of the group tested was unable to use the micrometer as required. This illustration of the practicability of your films is, of course, extreme; we would not teach the use of the micrometer in that manner, but it certainly shows that the films are doing everything and more than is claimed for them."

Supervising the production of these films is Dr. C. F. Klinefelter, assistant to Dr. Studebaker. He, in turn, is assisted by Floyd E. Brooker, motion picture technician, and J. W. Barrit, formerly supervisor of apprentices of the Westinghouse Electric & Manufacturing Co.

•

Hundredth Anniversary of Founder Marked

Now working 100 percent on war orders, a Philadelphia company paused last month to pay honor to the memory of its founder.

The interesting history of the Penn Metal Corporation was recalled by Frank E. Sagendorph, 2nd, president and general manager, on the 100th anniversary of the birth of the late L. Lewis Sagendorph.

The company got its start in Staunton, Va., in 1869. In 1883, the founder moved the business to Cincinnati and, with Major Harlan P. Lloyd, established the Sagendorph Iron Roofing & Corrugating Company.

One of industry's most notable figures entered the scene in 1869 when George M. Verity purchased the Cincinnati plant and its equipment, changing the name to the American Steel Roofing Company which, in time, became the American Rolling Mills Company.

L. Lewis Sagendorph returned to Philadelphia and remained in business, establishing the Penn Metal Ceiling & Roofing Company, today known as the Penn Metal Corporation of Pennsylvania.

•

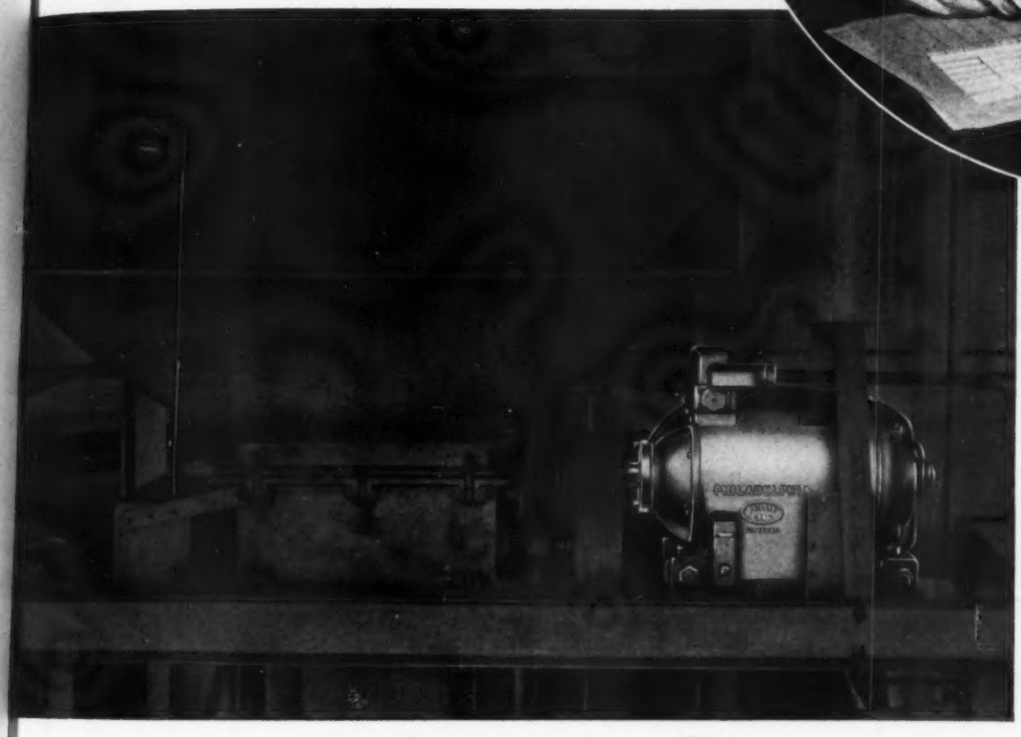
New York Attacks Jobless Problem

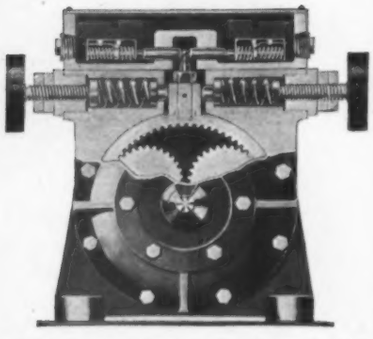
Of all America's big cities, New York has been least affected by the war boom. Or, to put it another way, the nation's

You just can't overload a PLANETORQUE -MOTOREDUCER

Here's a protection that's as positive as the fuse in your electric line . . . and as necessary, too. The PlaneTorque, MotoReduceR, the built-in drive with the safety feature that's constantly on guard, preventing damage to jammed or overloaded equipment. Instantly, when the load gets too heavy, power is shut off, breakdowns avoided, production delays eliminated. Yet, the drive is ready for action again as soon as the overload is removed . . . no switches or other gadgets to reset.

Install PlaneTorque MotoReduceR for operating conveyors, stokers, mixers, roll drives, and similar installations. It is compact and highly efficient with a dependability that's proven in service, again and again. Both horizontal and vertical types are available in a wide range of output speeds. Get our catalog M. R. 40 for more details.





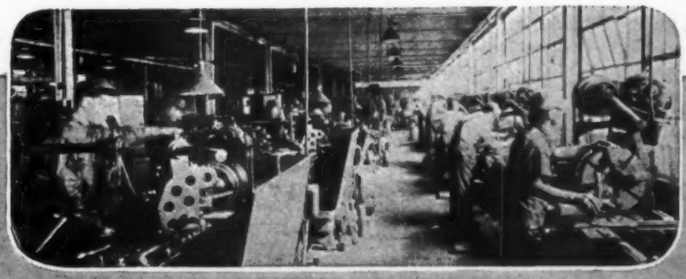
Cut-away view showing internal construction. PlaneTorque switch responds to overloads more quickly than electrical thermal relays since the mechanical action of the overload operates the cut out switch directly.

Type HS Horizontal MotoReduceR with PlaneTorque feature driving a color crusher.

PHILADELPHIA GEAR WORKS

INDUSTRIAL GEARS
AND SPEED REDUCERS
LIMITORQUE VALVE CONTROLS

ERIE AVENUE & G STREET
PHILADELPHIA, PA.
New York, Pittsburgh, Chicago



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LIMITORQUE CONTROL
operates all types of valves, etc., safely, economically, from convenient stations.

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GEARS
All types and sizes of industrial gears. Can be supplied in all materials.

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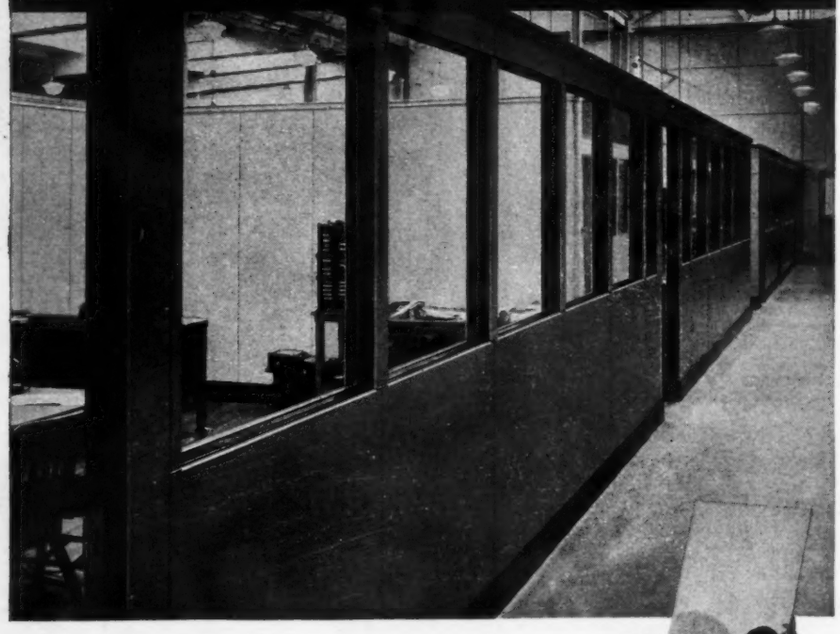
WORM GEAR SPEED REDUCER
right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.

Philadelphia
MOTOREDUCER
The economical self-contained drive, Horizontal or Vertical types — various ratios and horsepowers.

Philadelphia
HERRINGBONE SPEED REDUCER
for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.

For EMERGENCY
plant office construction



NO NEED FOR DELAYS—or makeshift materials—*even when you want a plant office put up practically overnight!* Just use J-M Transite Walls. These modern movable partitions go up fast—and long life with low maintenance is assured by their asbestos-cement composition. Check these other advantages:

RELEASES CRITICAL WAR MATERIALS. The two basic components of Transite Walls are asbestos and cement.

FORMS ANY TYPE PARTITION. Free-standing, ceiling-high, solid or in combination with glass.

FIRE-RESISTANT, STRONG. Resistant to fire because asbestos-cement cannot burn. Highly resistant to all kinds of factory-encountered shock and abuse.

ATTRACTIVE APPEARANCE. Natural, light-gray color specially adapted to plant or general office use. Finish is permanent. Requires no painting, unless desired.

For details on J-M Transite Walls, see our Catalog in Sweet's, or write for brochure TR-22A. Johns-Manville, 22 E. 40th St., New York.

JM PRODUCTS
JOHNS-MANVILLE
Transite Movable Asbestos Walls

financial capital has been adversely affected. In mid-September, when labor shortages gripped other cities, New York found itself with 400,000 unemployed.

Henry J. Kaiser, West Coast shipbuilder and steelman, moved in and visited upon New York the indignity of recruiting 20,000 of its jobless for his new West Coast cargo plane project.

Meanwhile, however, the city fathers had busied themselves in an effort to recapture Gotham's industrial status. Under chairmanship of George A. Sloan, City Commissioner of Commerce, a Business Advisory Committee was named by Mayor Fiorello La Guardia to turn the employment curve upward.

The Committee's first activity, a survey, disclosed the more or less obvious fact that what New York needed most was more war contracts. The bulk of New York's industries, which run to small sheet metal working and novelty plants, textiles, garments, and other civilian goods, are generally of the type least adaptable for conversion to defense production.

Sloan was forced to point out that further curtailments in civilian articles were in prospect which, in turn, meant more bad news for New York. But conversion, he said, was not impossible. Some of the most prominent victims of curtailment, such as printing, paints and chemicals, leather goods, and wood products, could be utilized almost fully on defense work in time, he declared.

Few Large Industrial Plants

Analysis also revealed that a much higher-than-average percentage of New York's industrial plants are genuinely small. No less than 26,413 out of the city's total of 27,174 manufacturing establishments employ less than 100 persons, it was reported.

Sloan recommended that the federal government establish a New York City Coordinating Corporation to operate as a branch of the new Smaller War Plants Corporation and "mobilize" the city's productive capacity by acting as a clearing house for new war contracts. He suggested that the agency be staffed, directed, and supervised by one or more of the city's leading engineering firms.

"Organized effort in production and management, more than anything else, is needed if the small plants are to have that type of engineering direction that characterizes the operations of larger plants," said Sloan. "The best is none too good for these thousands of small plants in the five boroughs of New York City that are desperately anxious to do their part in war production."

Historic Experiment

While New York struggled with this problem, Kaiser prepared to make the city the scene of an historic first experiment in mass movement of large members of industrial workers from coast to coast. He announced that he had obtained the services of 50 special trains to aid his recruiting agents in all parts of the country and that many of these would carry Kaiser employees out of New York.

"This man Kaiser must be all right!"

War Supplies Cannot Be Made by Men Who Cannot See

GIVE YOUR WORKERS AO GOGGLES

Last year, eye accidents took from the War Production Program, 9,455,000 man-days . . . enough time to build 600 bombers, or 15 destroyers, or 8,000 light tanks.

A flying chip will drop a worker from your ranks as quickly as an enemy bullet and upset production rates for a machine, a section, a department. That is *one* reason it more than pays to give all your skilled workers AO Goggles.

American Optical Company, manufacturers for more than 100 years of products to aid and protect vision, offers you a complete line of goggles to meet every type of industrial eye hazard. AO Goggles are comfortable to wear, lightweight and ventilated. Equipped with Super Armorplate lenses, AO Goggles offer maximum possible resistance to impact. Have your Safety Director call our nearest Branch Office, today.

American Optical

COMPANY

SOUTHBRIDGE, MASSACHUSETTS

Your Experiences with NE Steels!

Are you using NE steels? If so, what grades are you using? How do they heat treat? What are their machining qualities? What other fabricating results can you report?

Your answers to these questions are vitally important to the war effort. The use of "lean" NE grades, already adopted in many war plants, must be further increased to conserve critical alloying elements.

Results of your fabricating experience with NE steels are requested by the War Production Board for transmission to all war industries. Additional information thus gained will widen the use of these steels and directly benefit the conservation program.

The need is urgent. If you have data to report, please relay it to your steel supplier today.

Peter A. FRASSE and Co., Inc.

NEW YORK, PHILADELPHIA, BUFFALO, JERSEY CITY
HARTFORD, ROCHESTER, SYRACUSE

DISTRIBUTOR OF

FRASSE MECHANICAL STEELS

SEAMLESS STEEL TUBING • COLD FINISHED BARS
STAINLESS STEELS • WELDED STEEL TUBING • DRILL ROD
COLD ROLLED STRIP AND SHEETS • ALLOY STEELS

explained a 61-year-old former insurance salesman who had been jobless for over three years. He was one of the first to be hired for the trek across the country where dormitories and hastily constructed housing projects will shelter Kaiser's new working force. It was noted that older men, even those without previous industrial experience, had no difficulty in getting jobs from Kaiser's personnel men.

Before opening his New York hiring office, Kaiser checked with local representatives of the United States Employment Service and presumably sought their views on the type of man to hire as well as their assistance in seeking out men of some skill or mechanical ability.

•

Area-Wide Ride Swapping Developed in Dayton

When Dayton, Ohio, awoke to the true seriousness of the worker transportation crisis the city's industrial and civic leaders sprang quickly and efficiently into action.

Based on a study of other community plans, the Dayton Area Ride Swapping plan was brought into being under sponsorship of the Mayor's Emergency Committee on Transportation, headed by W. F. Switzer, early in August. Some 200 representatives of cooperating industrial companies and business houses attended the organization meeting and heard an explanation of the details of the plan. Then each representative, known within his own company as transportation chairman, was given an operating manual to guide him in putting the plan into practice.

Employers at the same time distributed to all employees a little booklet entitled "The Touching Story of Joe Allen," which relates the sad fate of a man who didn't believe there was a tire shortage.

Newspaper advertisements and radio spot announcements promoted the plan during the following week. Then, on a Monday, Ride Swappers' Section Maps (distributed by the committee) were put up in plants and offices throughout the city. Ride-swapping registration cards were handed out. Signers of the registration cards received windshield stickers to place in their cars.

Bulletin board posters and other material supplied by the committee helped further to promote the plan. In individual plants, employee magazines, pennants, posters, and special progress bulletins showing the number of people per car engaged in ride-swapping further stimulated interest in the drive.

•

Industrial Production Hits 183-Mark

The seasonally adjusted industrial production index of the Federal Reserve Board recorded further gains in August and early September climbing to a figure of 183 percent of the 1935-1939 average.

Leading gains were noted in munitions,

PERHAPS HERE'S THE ANSWER TO *YOUR* FINISHING PROBLEMS

TO HELP YOU solve those tough finishing problems in connection with war production work, a complete line of industrial finishes is available from our modernly equipped, new paint plant.

Our long experience in developing the exclusive varnishes and lacquers for Permite Ready-Mixed Aluminum Paints is now devoted to supplying U.S. Government specification finishes to war production manufacturers, for product finishing and for many interior and exterior uses.

The Permite Line of Industrial Finishes includes clear and colored ammunition lacquers, camouflage paints, zinc chromate primers, olive drab enamels, rust inhibitors, mixing varnishes and casein water paints. We can also supply Permite Aluminum Paints on WPB allocation.

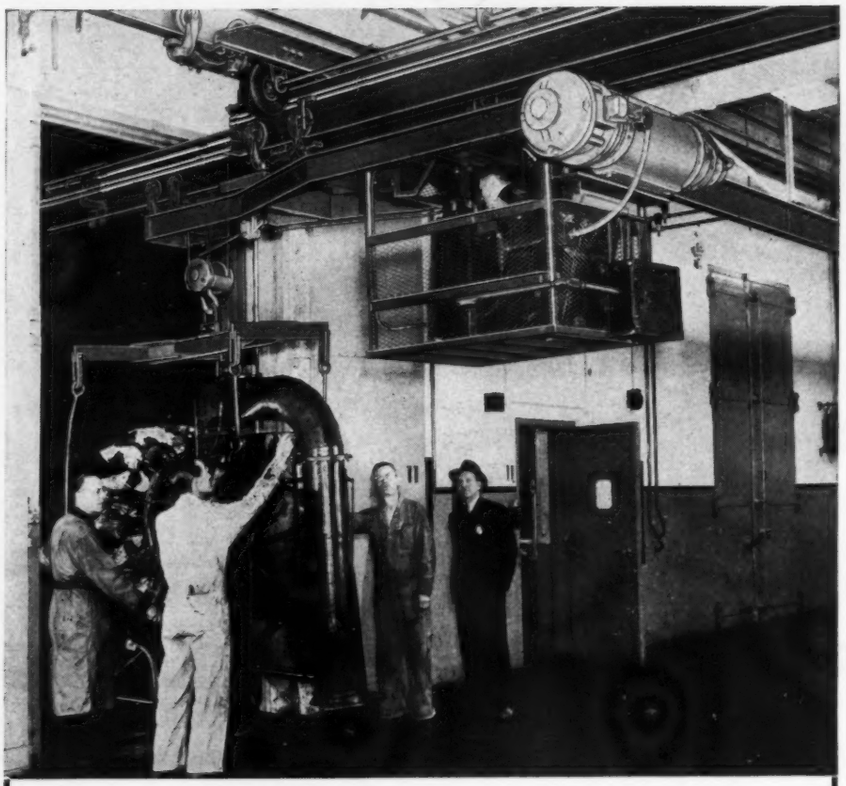
Your inquiry will receive our prompt attention.

ALUMINUM INDUSTRIES, Inc., *Cincinnati, Ohio*

Distributors in Principal Cities

PERMITE *Industrial FINISHES*

"AIR CARGO"
in your plant, too!



Proven over the years by

AMERICAN MONORAIL EQUIPMENT

FROM raw materials to finished products, in every operation, American MonoRail Equipment is speeding up production in countless numbers of plants. There is no installation too large and none too small that will not increase production, reduce accidents, reduce employee fatigue, release skilled hands from handling jobs and result in savings of time and money.

American MonoRail Engineers will gladly show you how American MonoRail Equipment will do all these and more in your plant. Write today, no obligation.

WRITE FOR Blue Book illustrating hundreds of MonoRail installations.

THE AMERICAN MONORAIL CO.

13114 Athens Avenue **Cleveland, Ohio**

★

machinery, and transportation equipment. Crude petroleum production recovered from the reduced level of earlier months, and construction contracts, although slightly lower than June and July's record high figures, remained at outstanding levels. Nearly 90 percent of the awards were for publicly financed projects.

Distribution of commodities to consumers increased decidedly, reflecting an upturn in department store sales by comparison with recent months. Last August's record sales, inspired by anticipatory buying, were not equaled, however. Average prices were up 12 percent.

•

Labor Control Preview Afforded by Britain

Total labor control, no simple matter, is easily explained in question-and-answer form by a recent British government pamphlet entitled, "Guide to the Essential Work Orders."

The questions are those which any typical British worker might ask under the heading, "How Do the Orders Affect Me?" The answers are those of the British Ministry of Labour.

Likewise, the pamphlet greatly helps the American observer to understand more fully just how Great Britain's highly mobilized labor force is being handled in the war crisis.

Here are some of the questions and their answers:

Question: Do the orders mean that I cannot change my job?

Answer: You may not give up your job without giving at least seven days' notice and without getting the permission of the National Service Officer.

Q. If I can't leave without permission, what about my employer? Can he dismiss me?

A. No, He, too, has to obtain the permission of the National Service Officer before dismissing you.

Q. And are there no exceptions to this?

A. Yes, if your employer thinks you have been guilty of serious misconduct he can dismiss you without having to get permission.

Q. And suppose I don't agree that I have committed serious misconduct. Have I a right of appeal?

A. You can appeal to the Local Appeal Board if you are dismissed for that reason.

Q. What about appeals in other cases?

A. You and your employer can also appeal to the Board if either of you disagrees with the National Service Officer's decision, but you must put in your appeal within seven days of the date of the National Service Officer's decision, which will be given you in writing. If you were dismissed for serious misconduct, you must appeal within seven days of the date of dismissal.

Q. Does the worker get any advantages from the orders?

BEFORE THE *Crucible* POURS A GUN!

"GUNS, MORE GUNS," is the cry of the hour — rifles, field guns, siege guns, howitzers, guns for battleships, and guns for submarines, guns for tanks and guns for bombers. Many of the mighty plants that produce these weapons — the veritable Crucible of Freedom — depend for efficient processing on the fact-finding, reporting fingers of *Instruments by Brown* — Pyrometers, Recording Thermometers, Potentiometers, Flowmeters — to name but a few. At the same time, *Controls by Minneapolis-Honeywell*, maintain effective plant temperatures, contribute to employee efficiency. *This Combined Control Service* is designed for all manufacturers, regardless of the nature of their product or the size of their operation. Those engaged in war production, or planning for it, will find the combined experience of Brown and M-H engineers a valuable aid in preparing for efficient, all-out production. Address Minneapolis-Honeywell Regulator Company, Minneapolis, Minn., or Toronto, Canada, or its subsidiary, Brown Instrument Co., Philadelphia, Penna.

Instruments by **BROWN** *and*
Controls by **MINNEAPOLIS-HONEYWELL**

FOR THE INDUSTRIES

Hammond
OF KALAMAZOO
AUTOMATIC FINISHING MACHINES
FOR
Burring, Brushing, Polishing, Buffing of
Plated or Base Metals

TYPE-J
MODEL
SB-6

These Hammond high-production 6 and 8 spindle table automatics are in use now — "helping to win the battle of production." If you have a problem in Burring, Brushing, Polishing or Buffing plated or base metals in plane parts, tank parts, bomb parts, and shells, send us samples — some in the rough, one acceptable finished piece — for complete engineering report. Don't delay, do it today!

VISIT OUR
BOOTH D-122
METAL SHOW
CLEVELAND
OCT. 12-16

OTHER HAMMOND PRODUCTS
CARBIDE, TOOL AND SNAGGING GRINDERS
ABRASIVE BELT SURFACERS, POLISHING LATHES

Hammond Machinery Builders INC.
1637 DOUGLAS AVENUE • KALAMAZOO • MICHIGAN
EASTERN BRANCH - 71 WEST 23RD STREET, NEW YORK CITY

A. Most certainly. He gets a guaranteed wage on certain conditions on days when no work is available for him. He gets paid, that is, even on the odd days when in peacetime he might have registered as unemployed at an Employment Exchange, and maybe because of the short spell not get benefit.

Q. And what are the conditions?

A. You must be willing and able to work during your normal working hours, and whenever your own job is not available you must be willing to switch over to other types of work which you can reasonably be asked to do.

Q. Suppose I were wrongly dismissed for serious misconduct and subsequently taken back. Do I get paid for the time I have lost?

A. Yes. If the National Service Officer directs that you are to be reinstated, you are entitled to the guaranteed wage from the date of dismissal until you take up work once more. This is, of course, provided that you satisfy the conditions referred to above.

Q. Can the guaranteed wage be reduced for any reason?

A. Yes. You are not entitled to a guaranteed wage during sickness or during a recognized holiday or if you are suspended from work for disciplinary reasons.

Q. This is the first time you have mentioned suspension from work. In what circumstances can such suspension take place?

A. If, quite apart from the Essential Work Orders, your employer could have suspended you for disciplinary reasons, he can still do so, but not for more than three days.

Q. Can I appeal against suspension?

A. Yes, if you do so within three days.

Q. And if it was unjustified . . . ?

A. If the Appeal Board thinks this, you will be entitled to your guaranteed wage for the time lost.

Q. Suppose I don't agree with my foreman or manager on a particular point . . . ?

A. If you disagree to the extent of failing to comply with a lawful and reasonable order, including any order about the working of day or night shifts, or of reasonable overtime, your employer may report you to the National Service Officer. This would be without prejudice to his right to dismiss you for serious misconduct.

Q. And if the National Service Officer thinks that I have been wrong . . . ?

A. He will probably give you directions about attendance at work, or your method or manner of work, and if he does so you must carry them out.

Q. Suppose I stay away from work or am late; what will happen?

A. It is to be hoped that you will not stay away or be late without reasonable excuse, but if you do you can be prose-

HELP FOR MEN WITH VALVES TO REPAIR

Newest "PIPING POINTERS" *Show How To Do It!*

TO keep pipe lines flowing and war production humming—now when piping replacements are hard to get—means that valves must be kept in proper repair. The latest "Piping Pointers" Bulletin answers dozens of questions on "how to do it!" Coming from Crane—America's largest manufacturer of valves—you can be sure the information it gives is sound and practical.

Not only does Bulletin No. 5 tell *how to do it,* but illustrates modern valve repair methods with actual photographs. It's a valuable reference for any piping man—*veteran* or *beginner;* ideal for employee training school use. It serves a dual purpose: (1) to help get renewed life from valves, (2) to conserve critical materials.

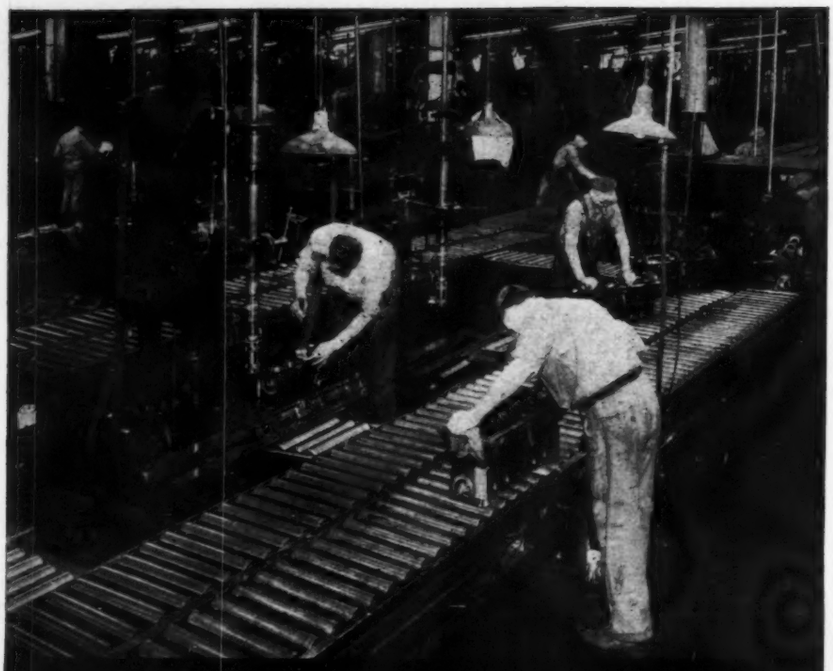
"Piping Pointers" Bulletins are one of the ways Crane Co., as the leader in its field, is sharing its basic information with other industries producing for Victory. Copies of Bulletin No. 5, and preceding issues covering other subjects of piping maintenance, are available *free* to any plant. Ask your Crane Representative or write direct for them.

CRANE

CRANE CO., GENERAL OFFICES:
836 SOUTH MICHIGAN AVENUE, CHICAGO
VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

To increase PLANT PRODUCTION



Mathews CONVEYER SYSTEMS

● The one sure way to increase production in your plant is to apply "The Continuous-Flow Principle" in the handling of your products in process. The Mathews Field Engineer can show you how this principle is working for others.

INCREASED CAPACITY FOR NATIONAL DEFENSE

Our plant capacity has been increased over 65% to care for the rising demands of the National Defense Program — plus the normal demands of peacetime production.

All orders, whether subject to Defense priorities or not, are given the same helpful care and attention that have always marked our dealings with prospects and customers in the past.

MATHEWS CONVEYER COMPANY

120 TENTH ST. - - - - ELLWOOD CITY, PA.

Field Engineers and Sales Offices located in 30 Industrial Centers.

cuted. If you have a reasonable excuse, nothing will happen to you.

Q. What can happen to me if I am prosecuted for an offense under the Essential Work Orders?

A. If you are found guilty you are liable on summary conviction for each offense—and giving up your job without permission is such an offense—to imprisonment for a term not exceeding three months or to a fine not exceeding £100, or both. There are heavier penalties for conviction on indictment.

Q. Suppose my employer disobeys the Orders?

A. The same penalties apply to him.

Q. You have mentioned the National Service Officer several times. Where do I find this Officer?

A. At the nearest Employment Exchange. Your application to him and your appeal to the Local Appeal Board should be sent in writing to that exchange.

Q. What is my position while I am waiting for the appeal to be heard?

A. The decision of the National Service Officer holds good unless and until he alters it.

●

Australians Also Build "the Will to Win"

In far-off Australia, manufacturers are conscious of the need for keeping up the morale of industrial workers.

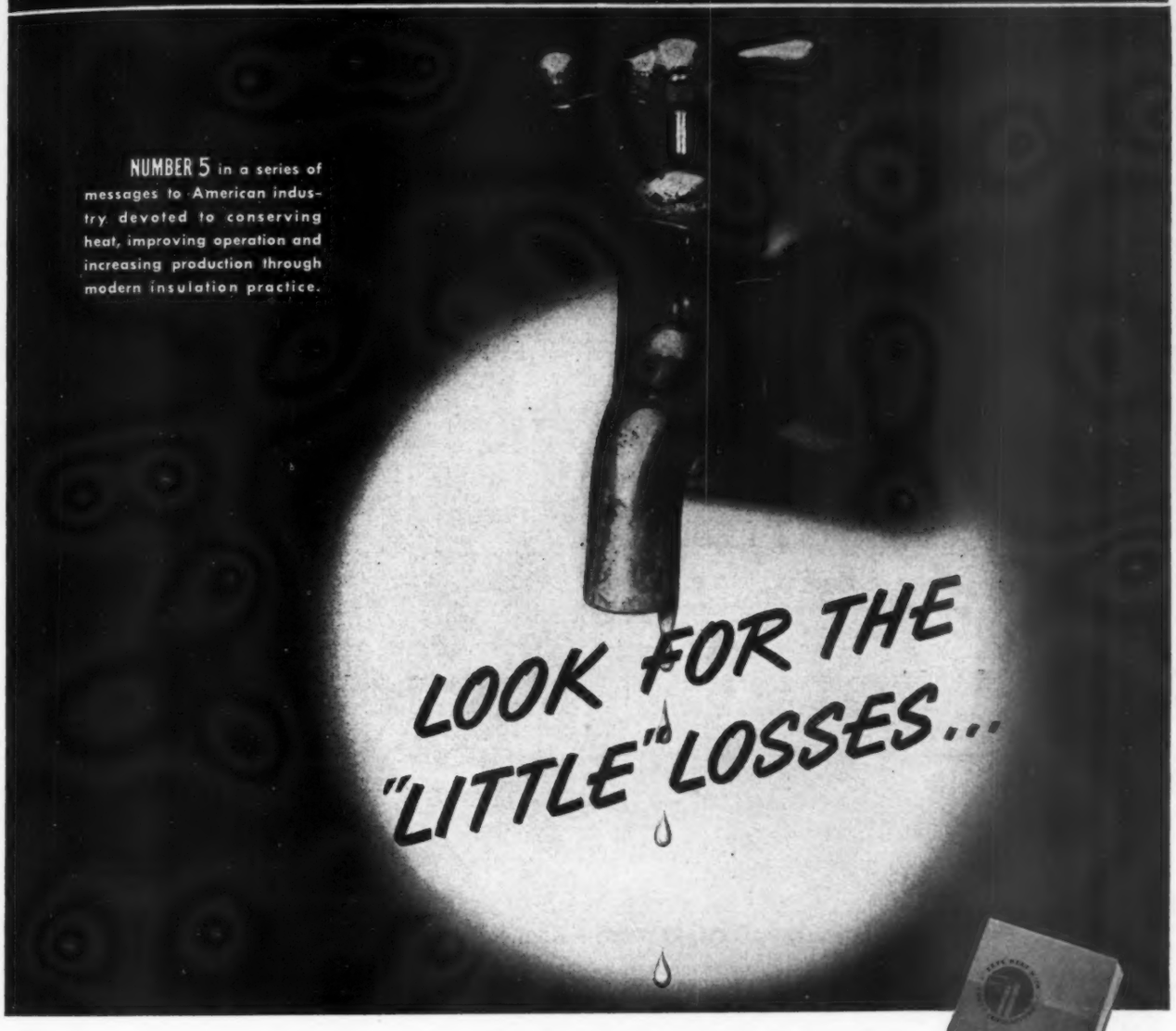
This is revealed in a recent letter to FACTORY from Ian McL. Smith, commercial manager of the Commercial Steels & Forge Company, Lidcombe, New South Wales. Expressing keen interest in FACTORY's series of articles on "Building the Will to Win," Smith said he found it "very heartening to feel that your soldiers, whom we see every day, have behind them factories and workers who are determined to come along the road with us right to the journey's end."

"In this country many companies have been engaged in all-out defense for up to two-and-a-half years and by now 'booster' programmes and 'pep' talks are old stuff," he declared. "Our problems are chiefly to keep the effort moving, to combat fatigue—both mental and physical—that has naturally come in the train of long hours at high pressure. We have found that many of these problems have required a more deep-seated remedy than merely inculcating a spirit of enthusiasm among all employees.

"Many factories have been working excess overtime and some of them have endeavored to keep a pace that could not possibly be sustained. This has been particularly evidenced among foremen and leading hands on whom an enormous burden has been placed, not only in supervising additional work but in training new and unskilled men. You can readily appreciate that the stage is reached when a man has no more energy to respond to appeals for greater production.

"Most factories, however, have over-

GETTING THE *MOST* FROM YOUR THERMAL INSULATIONS...


NUMBER 5 in a series of messages to American industry devoted to conserving heat, improving operation and increasing production through modern insulation practice.
LOOK FOR THE "LITTLE" LOSSES...

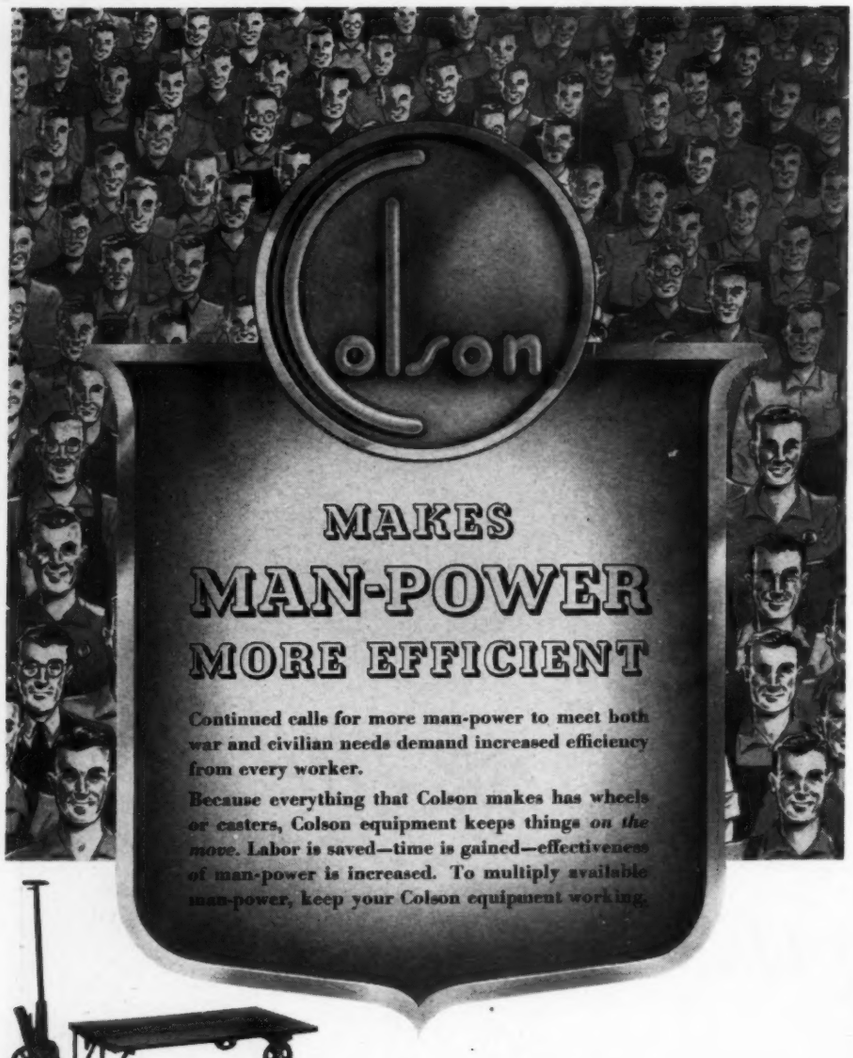
Like water lost from a leaking tap, the heat lost from an unprotected flange, valve or small pipe line may seem comparatively insignificant . . . but many of the few make much, and these steady small losses can quickly add to incredible totals.

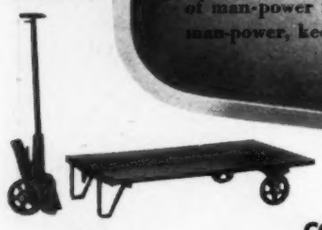
With operations under war demands proceeding at two and three times normal capacity, it is necessary that every possible pound of steam be generated, every last bit of heat conserved. The insulations on your boilers, piping and equipment should be maintained in good service condition, and all exposed lines, flanges and fittings should be adequately covered with an efficient, time-tested material . . . such as Ehret's 85% Magnesia.

★ EHRET'S 85% Magnesia and many other Ehret heat insulating materials are fully treated, both as to selection and application in the 176-page Ehret Heat Insulation Handbook. It will be furnished, without obligation, to those interested in getting the most from their thermal insulations. Write today for your copy of Handbook C210.

EHRET MAGNESIA MANUFACTURING CO.
VALLEY FORGE, PENNA.

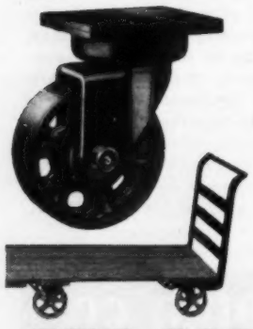
...THERE IS AN *EHRET* DISTRIBUTOR OR CONTRACTOR IN EVERY INDUSTRIAL AREA


Colson
MAKES
MAN-POWER
MORE EFFICIENT
Continued calls for more man-power to meet both war and civilian needs demand increased efficiency from every worker.
Because everything that Colson makes has wheels or casters, Colson equipment keeps things on the move. Labor is saved—time is gained—effectiveness of man-power is increased. To multiply available man-power, keep your Colson equipment working.



COLSON LIFT JACK SYSTEMS—Equipment that combines the advantages of a platform truck and a lift truck. Rapidly handles all kinds of material in storage or through manufacturing processes.

HANDLE BARRELS AND DRUMS SPEEDILY—No lifting to load. Safety assured because proper balance eliminates strain. Adjustable hook for barrels and drums 24″ to 40″ high.



CASTERS FOR EVERY PURPOSE—For wood equipment—for metal equipment—stem and flat top types—a wide range of sizes including caster wheels carrying loads up to 1500 pounds per caster.

INDUSTRIAL TRUCKS—Models for every use—hand, platform, box, tank, or rack equipment. All equipped with easy-rolling, long-wearing Colson casters.

THE COLSON CORPORATION
ELYRIA, OHIO
Offices and Agencies in Principal Cities
Colson
Casters • Industrial Trucks and Platforms • Lift Jack Systems • Bicycles • Children's Vehicles
Wheel Chairs • Wheel Stretchers • Inhalators • Tray Trucks • Dish Trucks • Instrument Tables

come these difficulties as they arose by an adjustment of working hours and by the elevation of other men to foreman and executive status and despite all difficulties they continue to achieve higher peaks of production.

"We have found, however, that intelligent internal advertising, such as is described in your article, is still very worth while, particularly that which is fundamentally based on a theme of pride, such as the information distributed by the Goodyear Tire Company which is referred to in your article."

•

AFL Now at Peak With 5,482,581

Recording a gain of 913,525 for the year, the American Federation of Labor has reached a peak membership of 5,482,581, George Meany, secretary-treasurer, reported last month.

Meany said some of the largest membership gains have occurred in war industries. The metal trades unions, whose members work in shipyards, aircraft, and munitions plants, made great gains, especially the machinists, ironworkers, and boilermakers, Meany said.

•

Frivolity Charge Arouses Women's Defenders

Officials of Boeing Aircraft's Seattle plants heard a more than mild hum of protest as a consequence of criticisms which they leveled at women industrial workers.

It all began when H. Oliver West, executive vice-president, told a group of visiting women newspaper correspondents that, while many of the women in his plant were doing fine work, a great many others seemed to be there "for other than serious purposes."

West declared that it was hard to get women to wear safe clothing in the vicinity of dangerous machines, that the rate of chronic absenteeism among women workers was much higher than among men, and that eventually, he believed, it would be necessary to segregate women confining them to the subassembly departments. He said women who worked as riveters' helpers were apt to prove a distraction.

As for absenteeism, Perry V. Ogden, Boeing factory manager, declared the percentage of women who failed to report on Monday mornings following payday was "alarming."

"We do fire the worst offenders," he confessed, "but if we fired them all we'd have few left."

These statements drew a derisive sniff from Mary Anderson of the Women's Division of the United States Department of Labor at Washington. Said she:

"It would seem Mr. West is one of those men who didn't want women in the

AAF Filters *protect them* from dust

Dust is a major problem both in the manufacture and maintenance of our great air armada. The important part which dust control plays in manufacture was soon discovered by airplane builders who turned to AAF engineers early in the war emergency to solve their dust problems.

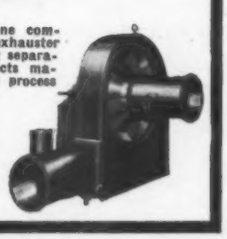
Following manufacture came maintenance, which due to make-shift airport facilities necessary in combat zones, again found dust a serious hazard. Engine performance records in Libya, Australia and elsewhere, made under actual fighting conditions, show that motors not protected by air filters, require overhauling and rebuilding after only 20 to 30 hours, due to the severe dust conditions. With AAF airplane engine filters, which remove 90% to 99% of the dust which causes this excessive wear, the overhaul period can be increased to 300 or 400 hours, thus saving valuable replacement parts and reducing oil and gas consumption.

So—on the line—in production and in combat AAF filters protect our war planes.

If you are confronted with a dust problem in your business—write us —we can help you too!

AAF airplane engine filters protect our fighting planes against destruction by dust.

AAF atmospheric dust control equipment is installed in every major airplane factory in the U. S. A.



Roto-Clone combined exhauster and dust separator protects materials in process and personnel against all forms of process dust

AMERICAN AAF AIR FILTERS

AMERICAN AIR FILTER COMPANY, INC., 361 CENTRAL AVE, LOUISVILLE, KY.
INCORPORATED
IN CANADA, DARLING BROTHERS, LIMITED, MONTREAL, P. Q.

Speed-up war production work!

Have YOU thought of the many uses your plant could make of

HEIN-WERNER
HYDRAULIC JACKS

★ **Super-Powerful**
★ **Easy-Operating**
★ **3 to 30 tons capacity**

If your factory is producing war materials, and if you lack certain machines and tools, it is probable that work can be speeded up if you'll tell them to use Hein-Werner Hydraulic Jacks. These super-powerful jacks are especially suitable on jobs involving lifting, pressing, bending, etc.

Purchasers of *over-a-million* Hein-Werner Jacks know that these jacks are compact, sturdy, safe, fast and easy to operate.

Complete line includes hydraulic jacks of 3, 5, 8, 12, 20 and 30 tons capacity.

Consult your industrial supply distributor, or write us for details and prices . . . Quick delivery can be made on orders carrying priority rating.

HEIN-WERNER MOTOR PARTS CORP.
Waukesha, Wisconsin

HEIN-WERNER HYDRAULIC JACKS
Are Built Right and Priced Right

plant in the first place. He is like a lot of foremen who, never having worked with women, are afraid of them. They complain: 'How can we work women? We can't cuss 'em out'."

In the East a management spokesman also rose to the defense of women. An official of the Glenn L. Martin Company, Baltimore aircraft manufacturers, declared "maybe West Coast women are different." In Baltimore, he said, "the majority feel they are contributing seriously to the nation's war effort."

•

Compulsory Service Forecast by McNutt

In a solemn warning to the nation, Paul V. McNutt, War Manpower Commission Chairman, added a forecast of compulsory national service to the somber speeches in which various national leaders brought home the seriousness of the war situation to the recent American Legion convention at Kansas City.

"America is faced with the urgent need to produce," said McNutt. "Every worker every man-hour of energy must be applied at that point which will help the war effort most. We are now seeking to obtain such ends as these by voluntary means. We are in this war to win and that means discipline. We, the people, are ready."

Louis Johnson, former Assistant Secretary of War, warned that in the post-war period, "under any international agreement of peace-loving, friendly countries, we shall also have to handle our economic resources so that no country in the world has any great motive to start on a mad career of aggression."

William P. Witherow, president of the National Association of Manufacturers, also looked into the post-war future to observe that the "future will not be wholly Washington-made, politically conceived, or fabricated alone by industry or labor."

"The best thinking of industry, labor, politicians, and other groups should be assembled," he said.

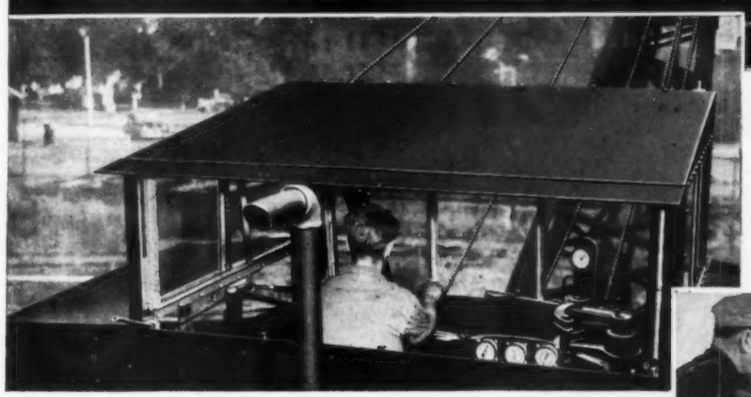
•

War Production Drive Memorandum No. 21

The Official Plan Book of the War Production Drive suggests that each joint labor-management committee establish a subcommittee on transportation to pool auto rides and save tires and gasoline. That this is a war of transportation as well as a war of production has become increasingly clear. Many of the joint committees have already organized subcommittees on transportation and have done valuable conservation work.

On June 19, 1942, the Office of Price Administration issued Amendment No. 16 to the Revised Tire Rationing Regulations. This Amendment provides for the issue of certificates by rationing boards to executives, engineers, technicians, and workers in industrial establishments, essential to the war effort, enabling such persons to purchase needed tires and tubes.

I.B. CRANES SPEED UP MATERIAL HANDLING



THROW YOUR SCRAP INTO THE FIGHT!

In these days when every minute of production time is doubly precious, the extra efficiency of I. B. Cranes is more vital than ever. The patented Monitor-type cab on gas and diesel cranes through 40 tons capacity speeds up operator production by providing 360° visibility, better ventilation and less noise. Operating levers and clutches are conveniently placed for greater ease of control. Undercarriage, rotating gears, crab mechanism, power plant, boom and rigging are all designed and built to do a faster, uninterrupted job of material handling.

Whether you use magnet, hook or bucket, it will pay you to operate an I. B. Crane. Write today for further facts.

INDUSTRIAL BROWNHOIST BUILDS BETTER CRANES

GENERAL OFFICES: BAY CITY, MICHIGAN • DISTRICT OFFICES: NEW YORK, PHILADELPHIA, PITTSBURGH, CLEVELAND, CHICAGO

FLEXPEDITE

Your

★ Conversion

★ Assembly

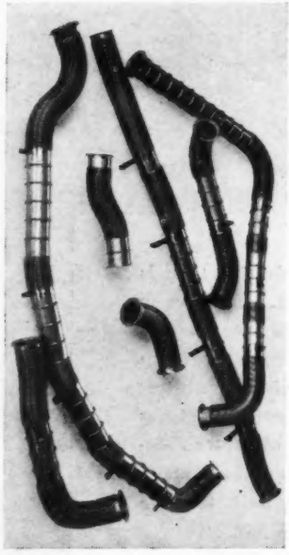
★ Production

with

REX *Flexible* METAL HOSE

In REX Flexible Metal Hose you have an immediate solution for your re-design problems where compactness and flexibility are imperative. Plus this, you conserve materials because REX Flexible Continuous Lengths Metal Hose eliminates the need for long lengths of piping and pipe joints. It enables engineers to simplify designs—provides the means for solving fluid and gas handling problems—speeds manufacture by facilitating assembly. There are easily attached fittings for every requirement. REX Flexible Metal Hose withstands flexing and vibration and assures better product performance.

Utilize this range of adaptability—write for data and engineering recommendations on specific problems involving flexible connections.



REX-WELD Corrugated Flexible Metal Hose. REX-TUBE Interlocked Flexible Metal Hose. REX-FLEX Stainless Steel Flexible Tubing. AVIO-FLEX Oil Line Hose. CELLU-LINED Hydraulic Hose.

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CHICAGO METAL HOSE CORPORATION

General Offices: MAYWOOD, ILLINOIS

Factories: Maywood and Elgin, Ill.

This Amendment becomes effective July 15, 1942.

The Amendment further provides that local rationing boards shall issue such certificates only if the applicant is employed at an establishment which has an organized transportation plan and presents with his application a written statement certifying that he meets certain requirements set forth in Amendment No. 16. The Amendment defines an Organized Transportation Plan as:

"A plan to transport with a minimum use of tires all war workers who require automobiles for transportation to and from their work. *Such a plan shall be organized and administered by a joint labor-management committee,* or some similar group or individual designated by agreement between or with the consent of management and labor to coordinate the transportation of workers."

The necessity for transporting war workers to work is intimately tied into our program to obtain "More Production". Amendment No. 16 states that joint labor-management committees, where they have an organized transportation plan can serve officially as the means for certifying applications to the local rationing boards which decide on the merits on each situation. Many joint committees which have not yet organized transportation plans will undoubtedly wish to do so at once. All committees which have organized such plans will wish to get in touch at once with their local rationing boards to establish a method of certification.

The organization and administration of a committee on transportation will require considerable time and effort from somebody. In order to be able to certify the needs of an individual worker to tire rationing boards, it will be necessary to show that he participates in group riding or otherwise complies with requirements. The distribution and analysis of questionnaires, the initial and follow-up arrangements for group riding, the immediate inclusion of new employees in the plan, and similar matters, will call for machinery which possibly the personnel department of a plant or some designated individual will need to operate under general policies determined by the committee.

•

G. E. Pays Employees $64,000 for Suggestions

More than $64,000 has been paid since January 1 to employees of the General Electric Company as a whole for suggestions adopted to speed war production, according to General Superintendent B. G. Tang.

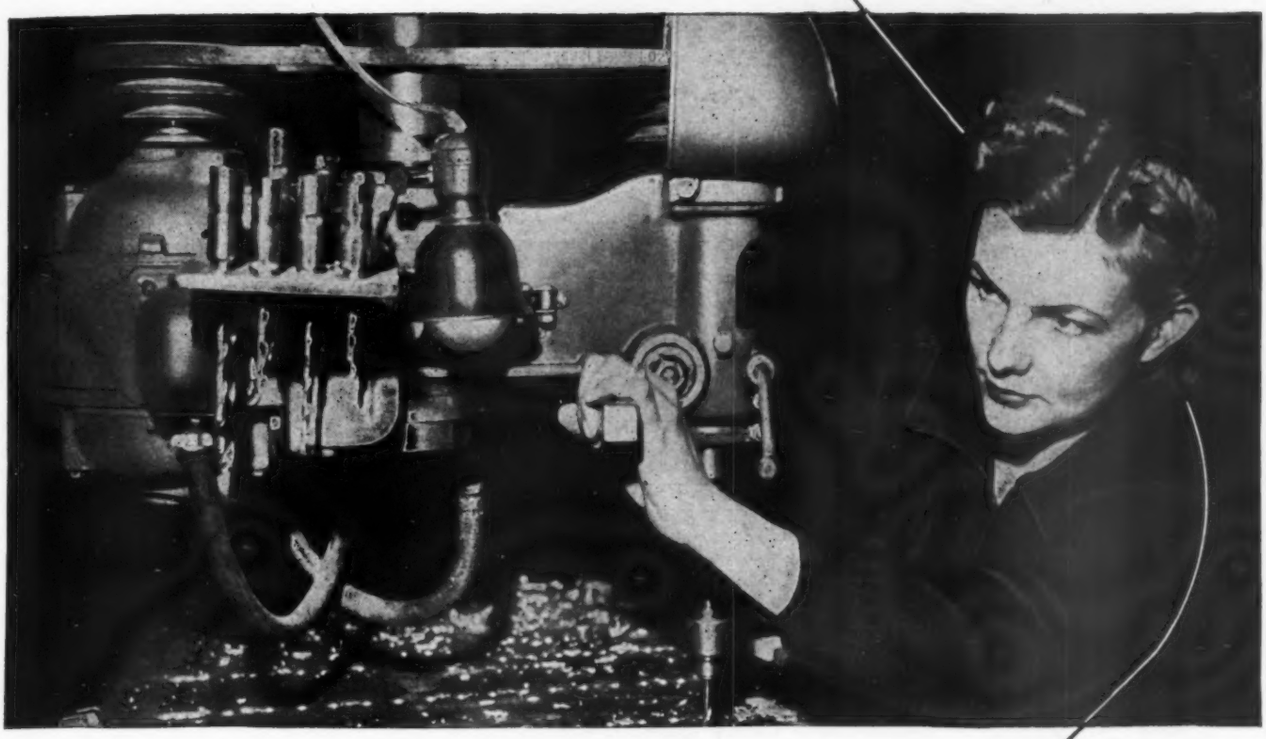
During this period, 7500 of approximately 25,000 submitted suggestions were adopted by the company, Mr. Tang revealed.

Among recent outstanding employee suggestions was one relating to an improvement to a particular type transmitter part, several of which are used in highly complex aviation equipment. This suggestion earned $350 for its originator, Miss Laura Garrison, who instructs new employees in a G.E. plant.

Another suggestion was an improvement

LIKE A DUCK TO WATER

WOMEN and unskilled operators take to these machines



AND here's the proof: Reports from shop superintendents and managers in plants (*names on request*) using Delta Drill Presses, Grinders, Saws and Cut-Off Machines read: ". . . unskilled operators can be used successfully due to the accuracy and perfect balance of Delta machines." ". . . with standard Delta Drill Presses we have built a special machine that enables us to use unskilled labor on an extremely difficult operation—thus freeing skilled mechanics for more difficult work." ". . . the training time and breaking in period have been considerably reduced with Delta machines—thus permitting us to take better advantage of unskilled labor." ". . . they are safer to operate, are more accurate and are built with precision balance, so we can use unskilled operators on most jobs . . ."

DELTA DESIGN
Always Offers These Advantages

Low First Cost
Low Maintenance Cost
Economical Operation
Reduced Labor Costs
Greater Flexibility
Portability

The complete DELTA-Milwaukee line consists of low-cost, high-quality Drill Presses, Cut-Off Machines, Grinders, Abrasive Finishing Machines, Saws, Lathes, Jointers and Shapers.

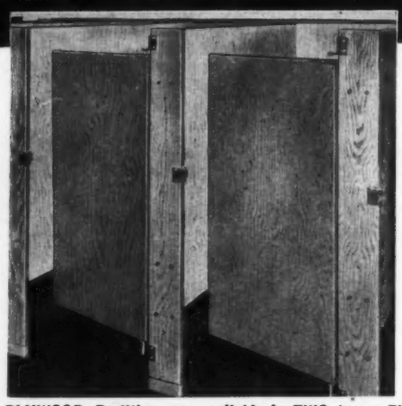
SEND FOR FREE "TOOLING TIPS"
Write for this practical shop bulletin showing how other manufacturers are taking advantage of the many features of DELTA-Milwaukee machines. Get in touch with your nearest Delta Industrial Distributor or write direct to The Delta Mfg. Co., 618-L E. Vienna Ave., Milwaukee, Wis.

DELTA
MILWAUKEE

. . . NEW LOW COST

PREFAB-PLYWOOD *Partitions* . . .

New aid to factory construction



Developed by the makers of famous FERRO-METAL partitions, these new Panels of NON-CRITICAL Fir *Plywood*, meet the urgent need for low cost, easily installed Washroom and Toilet Facilities.

Attractively designed, extremely low in cost, PREFAB-PLYWOOD Partitions are supplied complete, with all hardware, finished in grey or white enamel. They save time, labor and money on every installation.

PREFAB-PLYWOOD Partitions are available in TWO types—Flush or Panel. On the Panel type, the Plywood panels can be easily replaced with FERRO-METAL panels when these are again available.

• *Write for prices and specifications TODAY!* •

MILWAUKEE STAMPING COMPANY

809-P SOUTH 72nd STREET, MILWAUKEE, WISCONSIN

Write for this 16-page FREE SANITATION MANUAL!

Read how NEW Oakite material deodorizes, cleans and disinfects . . . performs ALL THREE functions in ONE simple operation!

In this informative manual you will find complete data on how to step-up sanitation efficiency, safeguard workers against infection and protect employee health more easily in your plant. Describes NEW, money-saving material, Oakite Deodorant No. 1, that does THREE jobs in ONE single, time-saving operation . . . deodorizes, cleans and disinfects . . . in washrooms, lavatories, shower stalls, locker rooms, etc. Also gives successful methods for solving related sanitation and odor control problems. Get YOUR copy NOW!

OAKITE PRODUCTS, INC., 14A Thames Street, NEW YORK

Representatives in All Principal Cities of the United States and Canada

OAKITE Specialized CLEANING

MATERIALS . . . METHODS . . . SERVICE — FOR EVERY CLEANING REQUIREMENT

in assembling radio equipment for the Army and Navy. This suggestion was offered by John Vos, employed in a G.E. radio testing department, who was awarded $400.

Other recent suggestions include a simpler method of assembling control equipment for Naval craft, means of conserving scarce materials in transmitter construction, an important tooling change on a lathe, and a quicker and better method for machining submarine parts.

•

Inventors Do Their Bit in War Effort

All kinds of inventions to aid the war effort are being worked out by patriotic Americans, in various parts of the country and connected with many different companies.

For instance, at the General Electric Company, a machine which will aid examination of armor plate, is being built. Housed in a special building with 3-ft. concrete walls, which make it resemble a bomb shelter, this machine will speed electrons to energies of 100,000,000 volts, and will produce X-rays of the same power.

Called an "induction electron accelerator," it will provide science with a new tool, the capabilities of which remain to be explored. However, as soon as it is completed, probably before the end of this year, the accelerator will be used for many urgent problems. One of them is a determination of the maximum thickness to which X-rays can usefully be applied for examination of armor plate and other very thick cross-sections. Eight inches of steel represents the practical limit for the convenient use of the million-volt industrial X-ray unit now in use.

Dr. Ernest E. Charlton, head of the X-ray section of the G.E. laboratory and W. F. Westendorp are responsible for the design and construction of the accelerator.

A 10-day record in "creating" a complete new series of alloy steels for special munitions purposes is announced by American Iron & Steel Institute. Usually new steels have taken years to develop.

The new steels were developed at the request of WPB. Five top-flight metallurgists were pressed into service, and the necessary research work was parceled out among them to avoid duplication of effort. Each mobilized his laboratory staff for day and night operation. Exactly ten days later full descriptions and characteristics of a brand new set of steels were laid before the WPB officials. These steels have been approved officially for war use, and are about to go into commercial production.

A real plane, performing acrobatics in the air such as occur in combat, is fired at with real shells. Gun sights are trained on the plane, but the gun fires in a different direction, preferably 180 degrees around the clock, but with the same elevation as the gun sight.

For determining hits and near misses, a binocular telescope is kept trained on the plane. By an arrangement of prisms, the image of the plane appears in one tube. In the other tube the spot 180 degrees

New CLECO 41-L Squeezer

with parallel jaw action

THAT INSURES BETTER RIVETING

★ The faces of the riveter arm dolly and the anvil arm dolly of the Cleco 41-L Alligator Squeezer are *always parallel regardless of the amount of gap.* This exclusive feature prevents disalignment ("clinched rivets") and loss of rivets; it insures tight rivets with uniform heads, and does not cause distortion in the surrounding metal. ★ The 41-L is new in design, but is built to the same uncompromising quality standards that have distinguished Cleco Tools for so many years. This squeezer is light and powerful; it weighs only 5½ lbs., is 12¼" long, and has a ⅛" rivet capacity. The working gap is 15/16", with full opening of 1½". It is equipped with automatic return throttle, and adjustable pressure "pop-off," as well as return limit stop on alligator jaw. ★ To meet your wartime production schedule you can't afford to be without this unique squeezer. *Write now for complete information.*

● These sketches show how the faces of the dollies on an ordinary squeezer are parallel when the gap is small. But as the gap increases, the faces cease to be parallel. (For the purposes of illustration, the angles have been exaggerated.)

● In contrast, note how the faces of the dollies on the 41-L Squeezer are *always* parallel regardless of the amount of gap.

The New Repairable Cleco Sheetholders with Latest Design Pliers.

THE CLEVELAND PNEUMATIC TOOL CO.

BRANCH OFFICES IN ALL PRINCIPAL CITIES

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FOR S. F. BOWSER CO.

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LONGER-LASTING

CAR-NA-VAR

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FLOOR TREATMENTS

Is the efficient maintenance of your floors being hampered by a manpower shortage? Then listen to what the S. F. Bowser Co., Inc., of Fort Wayne, Ind., says about longer-lasting Car-Na-Var floor treatments: "As a matter of fact, Car-Na-Var has reduced the amount of work necessary to maintain our floors by at least one-third."

While Car-Na-Var floor treatments cost a little more per gallon than most ordinary waxes, in the long run they not only save labor but actually cut over-all material costs as well. Want proof? Ask for demonstration on your own floors.

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A handy reference book for the maintenance man, giving the step-by-step treatment of every type of floor. Write for a copy today . . . no obligation.

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World's Largest Makers of Heavy Duty Floor Treatments

CAR-NA-VAR CAR-NA-LAC CAR-NA-SEAL

around the clock at the same height is seen. If the gunner's shell makes a "direct hit," the observer sees in the telescope the burst and the plane coinciding. For gaging near misses, the field of view is crossed by two sets of reference lines at right angles. If the gun burst does not appear in the field at all, the gunner has missed badly. For permanent record and later study, a camera that operates on the same principle, takes pictures at intervals.

These devices were invented by James C. Karnes of Buffalo, N. Y., who has received United States Patent No. 2,294,498. The inventor has assigned all rights in his invention to the United States Government without payment of any royalties to himself.

Other recent patent applications include:

A pocket umbrella with a telescoping handle in five parts and ribs that fold zigzag in three parts so that the entire device can be collapsed into a cylindrical handle.

A blackout street lamp which gives an illumination equal to one-sixtieth of the full moon, sufficient to distinguish a pedestrian 40 feet ahead. A nine-watt bulb is used. The War Department has approved the device.

An auto wheel attachment to prevent theft of either tire or wheel . . . a capless fountain pen which seals itself automatically against leaks . . . a "talking" postcard, which acts as a sounding board for a message recorded on a tape which is reproduced when a vibratory device is moved along the tape . . . glass springs which, while not as strong a steel, are highly resistant to the "fatigue" which affects most metals . . . an apple-picking device which snips off the fruit at the stem and conveys it down a pipe to a packing crate . . . a television "juke box" on the screen of which can be viewed any one of a number of pre-selected films . . . an aqueous liquid composition to prevent the fogging of windows . . . a pocket-size motion picture projector.

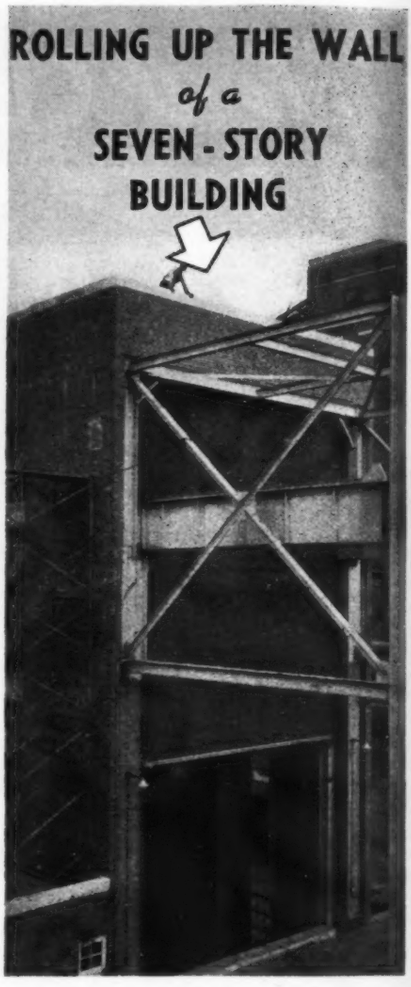
•

Developments of Concentration in Britain

In recent months, Britain has initiated a new policy in connection with the production of goods for civilian consumption. From now on, the resources available for civilian production are to be increasingly concentrated on the manufacture of standardized "utility" articles. "Utility" clothing is already a pronounced success; and the government is planning utility furniture, pottery, holloware, umbrellas, pencils, cutlery, suitcases, and many other civilian articles.

Britain's wartime policy for civilian goods may now be seen to fall into three stages. In the first—"Limitation"—controls were put on the total amount of raw materials to be used, and on the total amount of civilian supplies. In the second—"Concentration of Production"—factories producing civilian goods are drastically cut in number. In the third and perhaps final stage, standard fixed-price utility goods are produced, in a quantity calculated exactly to satisfy essential civilian needs.

ROLLING UP THE WALL *of a* SEVEN-STORY BUILDING



in 100 seconds

At the touch of an electric pushbutton, the whole rear wall of this transformer hoist house, *seven stories high*, rolls up into a small space beneath the roof — in only 100 seconds!

This "wall" is really a giant-sized Kinnear Rolling Door, 55 feet-six inches in height and 31 feet-four inches wide. It was built to fit a doorway big enough to permit a 120-ton overhead crane to move huge transformers through the opening.

But no matter how large or small the opening, Kinnear Rolling Doors offer the same advantage gained here — they save floor and wall space, open out of the way of all activity, and stay out of reach of damage. Their all-metal, interlocking-slat construction (originated by Kinnear!) not only stands up longer under harder service, but also gives more resistance to fire; more protection against intrusion, sabotage, theft, wind, and weather. They are ideal for any door requirement, and doubly advantageous in time of war!

Kinnear Rolling Doors are built to fit any opening, in new or old buildings. Available for motor, manual or mechanical operation. Easy and economical to install. Write today for complete data! The Kinnear Manufacturing Company, 1540-60 Fields Avenue, Columbus, Ohio.

Saving Ways in Doorways

KINNEAR ROLLING DOORS

Any Shape he Draws

A UNISHEAR can Follow!

. . . and cut it FASTER than any other tool!

Wherever sheet metal departments are "beating the promise", you'll find Stanley Unishears on the job. They slice through sheets as fast as you feed, up to 15 feet per minute – follow any line accurately, straight, curved or angle – leave smooth, clean edges with no distortion. Plenty of power and ruggedness for tough production or maintenance use.

Portable models with capacities up to 12 U. S. gauge hot rolled steel. Stationary models to handle sheet metal up to 10 gauge. Stanley Electric Tool Division, The Stanley Works, 151 Elm St., New Britain, Connecticut.

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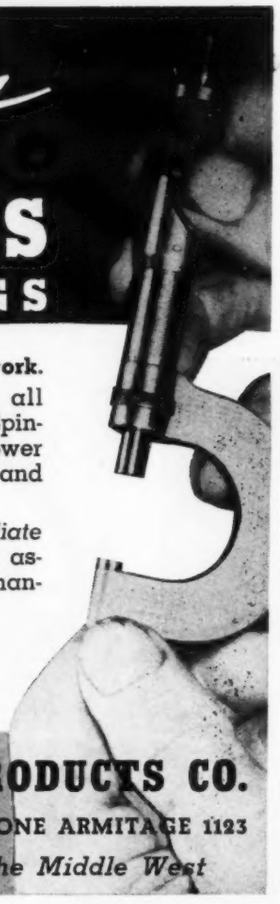
TOOLS ARE THE WORKER'S WEAPONS IN A TOTAL WAR. KEEP THEM ON THE JOB WITH PROPER CARE. . . .

STANLEY UNISHEARS

The Electrically Driven Hand Shears

Precision METAL SPINNINGS AND STAMPINGS



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These facilities are available for *immediate* production, to help in the fabrication and assembly of products where precision craftsmanship and quick service are of the essence!

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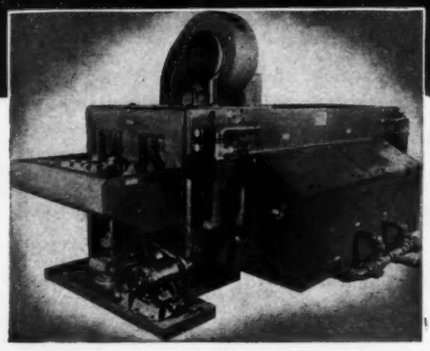
Three Vital Factors in War-time Metal Cleaning..



METHODS MATERIALS MACHINES!

Magnus Shell Washing Machine using Magnus Superail O for washing, rinsing, drying and cooling 75mm shells, at less than ½c per shell.

In war time, you can't consider the cleaning method independently of the metal washing machine or the cleaning material. Smooth, high-speed production depends upon the right machine and method. Effective cleaning depends upon the cleaning material—but it must be adapted to the method and the machine.

MAGNUS—A *COMPLETE* SERVICE

Put your metal cleaning problems up to Magnus for a complete solution.

Now you can get the machine best fitted to tie in with your production flow sheet and the cleaning material best suited to your particular products from one organization, geared up to consider your cleaning problem as a whole.

Magnus Materials and methods, used in a Magnus-designed washing machine specifically built for your own metal cleaning operations, insure maximum production, rigid adherence to quality standards and low overall costs.

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Manufacturers of Cleaning Materials, Industrial Soaps, Metallic Soaps, Sulfonated Oils, Emulsifying Agents and Metal Working Lubricants.

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In every aspect of Britain's life today, plans are made to concentrate the expenditure of time, effort, and material on civilian needs, to leave the maximum possible for war supplies. The nomination of 2000 clothing firms out of 25,000 in the industry to undertake the production of utility and government clothing is a striking example. Concentration has become today a much wider and more effective principle than when it was first applied to civilian production in March, 1941.

When the concentration plan was introduced in 1941, production for civilian needs had already been severely curtailed through government controls over raw materials, and through the "Limitation of Supplies Orders." Through these orders, factories making civilian goods were allowed to supply retailers with only a dwindling percentage of their previous supplies. In practice many civilian factories became engaged partially or wholly on war orders, some were working part-time on their former products, and some had closed down. The Concentration Plan was designed not so much to limit total production for civilian needs (which was already being achieved), but rather to rationalize future production to save part-time working and to release labor and factory space in areas where they would be useful to the war production program.

Nucleus Firms Given Privileges

The plan put forward was that in every industry covered by Limitation of Supplies Orders or by controls over raw materials, plants not working at full pace, or needed by the war program, were to cease operation and transfer their quota of production to "nucleus" firms. Nucleus firms were to be given certain privileges; their supply of labor and raw materials for essential production would be assured, and they would receive government orders. Every industry was asked to make its own arrangements voluntarily for the selection of nucleus firms, but the government undertook to give every firm closed through concentration a chance to re-open after the war.

In contrast with the later developments of concentration, the government worked, in its early plans, on the assumption that no unified plan would be necessary for every industry as a whole. Any firm, however small, could apply to be recognized as a nucleus firm provided that it could arrange to absorb enough production to keep it busy. There was no suggestion, at this stage, that standardized articles should be produced. On the contrary the government hoped that nucleus firms would be able to make specialized articles for the closed firms who would continue to market these articles to their own customers.

The government offered no compensation to firms to close, the established principle being that the government does not pay any compensation for war losses except for those due to direct enemy action. Manufacturers accepted the necessity to make any sacrifice needed for the war effort. What compensation there was for closed firms was provided by the nucleus firms in one of various ways: By manufacturing for the closed firm at cost

CHANGING FROM THIS TO THIS
Boosted Production 15%
Cut Wheel Costs 50%
Foreman: "They asked me if the grinding department could possibly turn out more of certain parts with present equipment. I began experimenting. I changed the wheel combination from the old standard and it worked! We cut down grinding wheel costs and got more pieces per hour. So if you can't get more grinding machines, try some wheel experiments. Try telephoning a Norton engineer for a tip."
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COMPARE the "Dustube" point-by-point and you will see how well it meets your dust control needs.

It is *Simple:* The cloth tubes can be quickly installed, inspected or removed; they are light and economical to ship and store; they prevent bridging and clogging; being amply spaced they decrease resistance to air flow, therefore, there is a saving in power and the air velocity throughout the collector is kept uniform; the tubes clean more rapidly and thoroughly because they are shaken like a rug while limp and deflated.

It is *Economical:* Operating and maintenance costs are confined to power for operating the fan and shaker and the occasional replacement of an inexpensive cloth tube.

It is *Efficient:* Performance records show that its efficiency by weight is 98% and more; by dust count the discharged air shows less than ten million particles per cubic foot from two to ten microns in size.

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price; by buying the closed firm's wartime quota; by paying a levy towards a compensation fund; or by sharing the profits; or by buying out the closed firm. In every way the government tried to encourage arrangements which would leave the closed firms intact. It gave every industry a time limit to produce voluntary plans, in default of which compulsory plans were to be applied by the government.

Within 14 months, 250,000 workers and 55,000 square feet of factory space had been released through concentration. The workers were largely factory-trained and thus valuable for war production. Factory space was allocated for war production or storage by a special department of the Board of Trade.

During this period, concentration was already beginning to take new forms. In production, the new tendencies were for the government to take a direct part in deciding not only the amount of production but the exact articles which were to be produced, and the firms which were to produce them. Outside production, concentration was extended to cover the distribution of food, the Civil Service, banks and financed institutions; and plans were even discussed for the concentration of all the retail trade in goods other than food.

Plan for Clothing Industry

Typical of the new attitude to concentration is the plan for the clothing industry. Out of about 25,000 firms engaged in making up clothing about 2000 (the large mass producing firms) have been "designated" to produce all the utility clothing. With the cloth manufacturers allowed to produce very little but utility cloth, and with the consumer spending his coupons almost entirely on utility clothes, the pattern for this industry is thus complete.

"Utility" products were defined as "goods sufficiently clearly designed for their prices to be fixed, planned to meet essential needs in a sensible manner and produced in the most economical way possible." As a counterpart to the production of utility goods in every suitable industry, the government is prohibiting the production of any articles that do not fit into this program. It is estimated that this policy will immediately release 30,000 additional workers for war work, and increase the supply of essential requirements.

Typical also of the latest developments are the efforts made to extend or simplify existing concentration plans. Some industries have been re-concentrated. The paper box and carton industry, which could not achieve concentration, is now being surveyed for compulsory concentration. Plans are being prepared for paint and varnish, jute, laundries, and other industries. In the cotton industry, on the other hand, it was found that concentration could be carried too far.

Independently of the Board of Trade, the Ministry of Food has been active in applying concentration wherever possible to the production of food. Since 1940, margarine and cooking facts have been manufactured by one combine representing all manufacturers, and producing a standard unbranded article. Slaughtering cattle and dressing meat have been restricted to 800 slaughterhouses.

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